THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR WILLIAM JAMES HOAR

TITLE OF THESIS EFFECTS OF DOMESTIC GRAIN GRADES ON THE OPERATIONAL EFFICIENCY OF ALBERTA PRIMARY ELEVATORS

DEGREE FOR WHICH THESIS WAS PRESENTED MASTER OF SCIENCE

YEAR THIS DEGREE GRANTED FALL, 1980

THE UNIVERSITY OF ALBERTA

EFFECTS OF DOMESTIC GRAIN GRADES ON THE OPERATIONAL EFFICIENCY OF ALBERTA PRIMARY ELEVATORS

by

© WILLIAM JAMES HOAR

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

IN AGRICULTURAL ECONOMICS

DEPARTMENT OF RURAL ECONOMY

EDMONTON, ALBERTA

FALL, 1980

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled EFFECTS OF DOMESTIC GRAIN GRADES ON THE OPERATIONAL EFFICIENCY OF ALBERTA PRIMARY ELEVATORS submitted by WILLIAM JAMES HOAR in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE.

DEDICATED TO MY PARENTS

ABSTRACT

This thesis analyzed the operational efficiency of the Alberta primary elevator industry for the crop years 1975/76, 1976/77, 1977/78 and 1978/79. The study looked at elevator costs and elevator receipts of grain for each year separately and for a four year period. The central focus of this research was to determine the impact the present number of domestic grain grades, as defined under the Canada Grain Act, have on the operational efficiency of primary elevators. In addition, economies of scale and regional effects present in the primary elevator system were also examined.

The principle hypothesis maintained was that the present number of domestic grades are putting unnecessary cost pressure and throughput restrictions on the primary elevator system in relation to the market advantages producers and buyers obtain from such a system.

The number of grades received by primary elevators was found to have an effect on average costs. As the number of grades received by primary elevators increased then average cost also increased. This relationship was found to be significant at the .01 level. However, the cost increase can be considered minimal for most elevator operations and one can conclude that the present primary elevator system in Alberta can adequately handle the number of domestic grades within the Canadian grain handling system. No reduction in

the number of grades utilized within the Canadian grading system can be recommended for reasons of increased operational efficiency of primary elevators at this time yet any additions, such as the move to increased grading by protein levels, should be considered carefully.

Other factors studied in order to determine the effect on operational efficiency of primary elevators were handling ratio, grain receipts, elevator capacity, elevator age, and the number of grains received.

The single most important factor in lowering average cost within the primary elevator system is the receipts of grain to elevator storage capacity (handling ratio). While decreasing the number of elevators within the system can improve operational efficiency of primary elevators by increasing this handling ratio, and ameliorate efficiency in grain car collection by reducing trackage and collection points, it also shifts the incidence of cost to farm trucking and provincial road components.

The goal to achieve is to keep the number of grades received by primary elevators at a level where primary elevators are operating efficiently, as well as other operations in the grain handling and transportation system, and at the same time transmit reliable market information to producers and buyers.

ACKNOWLEDGMENTS

Throughout the course of my study, I have become indebted to many individuals and organizations for their knowledge and inspiration. First, I wish to take this opportunity to express my sincere thanks to Dr. M.L. Lerohl and Dr. M.H. Hawkins for their continued guidance, support and understanding throughout my program. The co-operative effort shown by Mel and Murray was truly a rewarding experience and I thank them both. I would also like to express gratitude to the other members of my committee, Dr. M. McMillan and B. Friesen, for their constructive criticisms and suggestions.

Thanks is also extended to other staff and fellow graduate students for their assistance and encouragement, particularly J. Copeland, C. Shier and Dr. W. Phillips.

Special thanks to the Administrators, Directors and Staff of the Alberta Wheat Pool and United Grain Growers is due, for without their interest and support this thesis would not have been possible. I would especially like to express appreciation to A. Beattie, G. Evans, D. Freed, M. Iga and R. Nielsen of Alberta Wheat Pool, and A. Boes and M. Senkiw of United Grain Growers.

I would also like to make acknowledgment to Alberta Agricultural Research Trust for providing financial assistance toward this research.

[illegible]

[illegible]

[illegible]

I am also grateful to those who provided editorial advice and encouragement. A. Hoar, D. Hycha, E. Nelson and E. Shapka made many helpful suggestions and contributions towards the completion of the manuscript.

My parents and friends deserve much of the credit which has enabled me to persue my educational career thus far and to them I am extremely grateful.

Table of Contents

List of Tables

List of Figures

I. INTRODUCTION

Marketing problems related to grain handling and transportation have emerged in Canada before the turn of the century. Since that time, improvements to the marketing of Canadian grain have been frequently discussed in Canadian agriculture.

The 1899 Senkler Royal Commission on the Shipment and Transportation of Grain was the first of many Royal Commissions which looked into the problems of the grain industry and grain transportation. The Hall Commission categorizes grain handling and transportation problems or "persistent issues" into two broad groups: "organization of the grain handling and transportation system and freight rates."[1] These problems and issues, concerning an operationally efficient system for handling and transporting grain, bring forth three major questions which must be resolved by the participants within the grain industry:

Transportation Costs - by what combination should the producer, the railway and the government pay for the cost of transporting grain by rail, and by what method should any payment be disbursed;

Institutional Environment - should the grain handling and transportation system be guided by the open market system, the board market system, or by some combination of the two; and,

----

[1] Hall Commission, Grain and Rail in Western Canada, Ottawa: Supply and Services, 1977, Vol. I, p. 19.

Economic Distortions - how can the economic distortions in the grain transportation sectors (labor problems, tariff and rate structures) be minimized without placing undue burden on participants in the grain industry?

Obvious effects of the problems in handling and transporting western Canadian grain are lost and deferred sales. According to the Canadian Wheat Board Report to Producers, delivery of 1.9 million tonnes of grain was deferred and requests for additional sales of at least 2.0 million tonnes had to be turned down in the 1977-78 crop year.[1] In addition, demurrage totalled over 18.3 million dollars for the Canadian Wheat Board pool account for wheat in 1977-78.[2]

These lost or deferred sales were not as a result of grain being unavailable at the farm level. Farm stocks as a percentage of annual production have been increasing since 1975. According to sources[3] for the 1977-78 crop year, farm stocks as a percentage of production of grains and oilseeds was 24.9%. Similar estimates for the 1978-79 crop year place farm stocks as a percentage of total grain and oilseed

----

[1]It had been estimated that the cost to producers of deferred and lost sales was in the range of $450 to $500 million dollars in 1977-78. Similar projections for the 1978-79 crop year estimate the value of lost sales at $600 million dollars.

[2]Canadian Wheat Board, Annual Report, 1977/78, Winnipeg: C.W.B., 1979, p. 41. Demurrage represents charges paid or estimated charges payable to vessel owners, for delays in loading beyond a normal period, relating to producers' deliveries in the current crop year.

[3]Canadian Wheat Board, Annual Report, 1977/78, Winnipeg: C.W.B., 1979, p. 25, Table III, p.3.

production to be over 30%.[1]

Holding of increased farm stocks not only represents deferred income but an increased cost to farmers in the form of storage facilities and reduced cash flow. Western Canada has been able to produce and find a market for grain in the past; however, lost and deferred sales can deter buyer confidence in Canada's ability to meet future export volumes.[2]

Considering forecasts[3] of total production of principal grains and total export movements for 1985, Canada's grain handling and transportation system will have to undergo major improvements. The Canadian Wheat Board estimates Canada should be able to export approximately 30 million tonnes of grain in 1985. This represents a 50% increase over 1978 export volumes, and an ambitious undertaking for the existing grain handling and transportation system.

In the early 1970s, improvements in volume capabilities were attributed to several factors:

1. Block shipping system;
2. Car pooling and improved port coordination;
3. Partial work week extension, (Saturday loading and unloading);
4. Grade options possible within large long term contracts, and in a sellers' market; and,

----

[1]This is based on preliminary estimates of 13.5 million tonnes of farm stocks at year end and 41.4 million tonnes of production.

[2]During the period from 1966-67 to 1975-76 when the world trade in grain increased by 60%, Canadian grain exports increased by 4%. This resulted in a decrease of the Canadian share of the world grain trade from 16.7% to 10.9%.

[3]Canada Grain Council's and Canadian Wheat Board's forecasts. Also see Appendix A.

5. Leasing of additional rolling stock and diesels by the railways.[1]

Problems and issues still face the grain handling and transportation system in the 1980s:[2] producer cash flow problems; cost escalation at the primary and terminal elevators; cost escalation and revenue shortfall of the railway system; railway capacity and branchline abandonment; and, the future role of government in the grain industry.

Improvements have been made to the grain industry, yet any solutions to problems related to efficient handling and transportation of grain must be considered carefully before any changes are implemented.

A. Marketing Efficiency

Marketing efficiency (ME) can be expressed as a function of operational efficiency (OE) and pricing efficiency (PE):[3]

$$ME = f(OE,PE)$$

The term operational efficiency pertains to how well the

----

[1]Canada Grains Council, Grain Handling and Transportation, State of the Industry, Winnipeg: C.G.C., 1973, p. 89.
[2]For a summary analysis of problems and issues refer to, Canada Grains Council, Grain Handling and Transportation Definition of the Problem, Winnipeg: C.G.C., 1975. For a comprehensive analysis of problems and issues refer to, Canada Grains Council, Grain Handling and Transportation: State of the Industry, Winnipeg: C.G.C., 1973, and Booz-Allen and Hamilton Inc., Grain Transportation and Handling in Western Canada: Technical Report, Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.)
[3]A.A. Warrack, "A Conceptual Framework for Analysis of Marketing Efficiency", Canadian Journal of Agricultural Economics 20(1972), p. 14.

physical part of marketing is done - the quantity and quality of services performed relative to the resources used.[1]

Williams and Stout utilize the concept of "optimization" in their definition of operational efficiency:

> Operational efficiency in marketing refers to all of the adjustments that might be made by individual firms, both in the short run and in the long run, to reduce per unit costs. In the short run, the operationally most efficient firm will (1) select the input-output techniques and methods, the production functions, that within limitations imposed by fixed facilities maximize output per unit of input, (2) determine and employ the optimum or least cost combination of factors and ingredients, and (3) minimize procurement and distribution costs ...[2]

Price efficiency can be expressed and described as exchange efficiency or co-ordination to the entire production and marketing sequence.[3] Price efficiency is concerned with improving the operation of buying, selling and pricing aspects of the marketing process so that the

----

[1]Harold F. Breimyer, Economics of the Product Markets of Agriculture, Ames: Iowa State University Press, 1976, p. 125.

[2]Willard F. Williams and Thomas T. Stout, Economics of the Livestock-Meat Industry, New York: The Macmillan Company, 1964, p. 139.

The optimum amount of input is that amount which creates maximum profit. The profit maximizing criterion for two variable inputs is usually expressed in the following terms:

$$\frac{MVP_1}{P_1} = \frac{MVP_2}{P_2} = 1$$

[3]Harold F. Breimyer, Economics of the Product Markets of Agriculture, Ames: Iowa State University Press, 1976, p. 126.

market system will remain responsive to consumer direction.

Concern has been expressed that the present "primary grain grading system"[1] has concentrated to a larger degree on exchange efficiency instead of operational efficiency.[2] Grades and standards for grain have tended toward improving the operations of buying, selling and pricing without full consideration of the effects on operational efficiency. This study will be an analysis of the effect primary grain standards have on the operational efficiency of the grain handling system at the primary elevator level.[3] Operationally efficient marketing of grain is of concern to the producers, the grain trade, and the general economy of the country.

B. Problem

The specific problem examined in this study is the effect of our present Canadian primary grain grade standards on the operational efficiency of the country elevator system in western Canada.

Research by Martin, _et al_, suggests that a key element in achieving a low cost country grain handling system is the

----

[1]The terms primary grain grading and domestic grain grading are used interchangeably within the grain industry. Grades are discussed in detail in Chapter III.

[2]Booz-Allen and Hamilton Inc., _Grain Transportation and Handling in Western Canada_: _Technical Report_, Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.) Chapter XI, p. 14.

[3]Primary elevator An elevaton used principally for receiving grain directly from producers for either or both storage and forwarding. A detailed description of elevators is provided in Chapter IV.

efficient operation of country elevators. They suggest efficiency can be achieved by primary[1] elevators concentrating on throughput:

> As rail lines are abandoned and elevators consolidated, the operation of individual elevators acts as a fulcrum in a delicate balancing act; rail costs decline while farm costs increase and the key variable that determines if overall costs are reduced is the operation of the elevator. For example, smaller elevators that turn over four or five times have significantly lower costs per bushel than larger elevators turing over less frequently. Thus, it is extremely important to know what happens to total system costs when elevator companies abandon small elevators and build larger elevators in centers (like Moose Jaw, Swift Current, Weyburn, Rosetown) that already have sufficient storage capacity for a relatively high handling to capacity ratio.[2]

The relationship between the grading and transportation of grain may seem indirect; however, it would appear that any effect of grading on transportation would influence the throughput of country elevators. The Canada Grains Council states:

> Each segregation of grain by grade adds to the amount of storage space required in the primary elevator and also in the terminal elevator of handling a specific volume of grain. Specifications of grades as to foreign material affect the need for and use of cleaning facilities in elevators, use of such facilities tending to reduce throughput. Each grade essentially represents an individual commodity which must be stored, transported, processed and shipped separately, this being most apparent in the case of the top grades of red spring wheat. Furthermore, as the number of grades increase so do the possibilities for misshipments, such also

----

[1]Within the grain industry, primary elevators are used synonymously with country elevators.
[2]F.L. Martin, D.G. Devine, and S.N. Kulshreshtha, "Centralized Prairie Grain Collection: Savings Related to Market Efficiency," Canadian Journal of Agricultural Economics 26(2), 1978, p. 6.

> tending to reduce the throughput capability of the handling system and also that of the transportation system to deliver grain in relation to needs of the market.[1]

A report by Booz-Allen[2] also made reference to primary elevator efficiency. The report stated that the number of domestic grain grades should be evaluated because of the possible "impact on efficiency"[3] of primary elevators. The report stated:

> When more grades are handled in a particular elevator, more subdivisions of storage are required and the effective storage capacity is reduced. A reduction in the number of grades would have benefits by increasing primary elevator operational efficiency and effective port terminal capacity, as well as simplifying the inventory control system. This cost of maintenance of a large number of grades should be very carefully assessed against the marketing advantages.[4]

It is on "...the cost of maintenance of a large number of grades..."[5] at the primary elevator level that this research will focus.

C. Objectives of the Study

The primary objectives of this study are:

1. To determine the effect on average cost of maintaining current primary grade standards at the primary elevator

----

[1]Canada Grains Council, <u>Key Issues in Grain Transportation</u>, Winnipeg: Canada Grains Council, 1979, p. 99.
[2]Booz-Allen and Hamilton Inc., <u>Grain Transportation and Handling in Western Canada: Technical Report</u>, Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.)
[3]<u>Ibid</u>., Chapter XI, p. 14.
[4]<u>Ibid</u>., Chapter XI, p. 14.
[5]<u>Ibid</u>., Chapter XI, p. 14.

level;

2. To determine and quantify the costs pertaining to the major factors of handling and storing grain at primary elevators (the specific factors and variables are introduced in the hypotheses); and,
3. To provide an empirical basis on which planning and policy recommendations can be made to the future of Canadian grain grading and primary elevators.

D. Hypotheses

The primary hypothesis maintained that as the number of grades handled by primary elevators increases, the average cost of handling and storing grain increases. The use of fewer grades of grain would appear to simplify handling, increase throughput, and lower the cost of handling grain.[1] While a multiplicity of grades may extract higher prices per unit sold in the market, it is possible that producer net returns would be increased by having fewer yet equally rigidly administered grades.

----

[1]See Figure I-1 and Figure I-2, p. 10.

Figure I-1

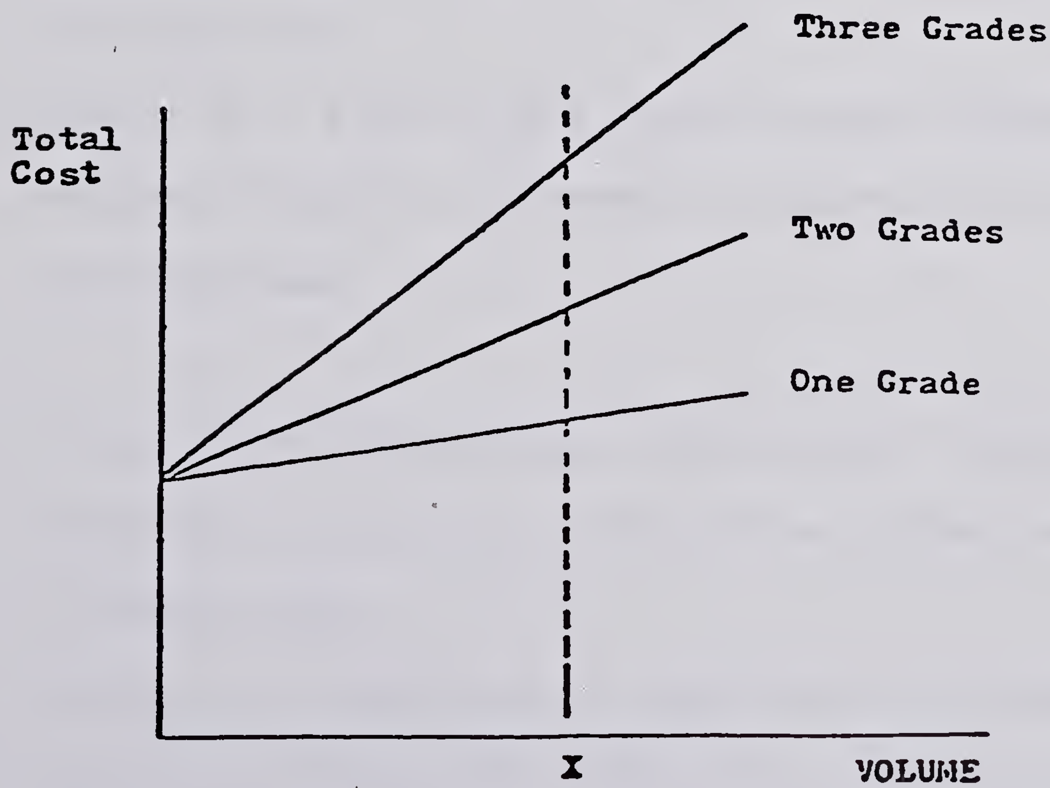
EFFECT OF GRADES

ON AVERAGE COST OF PRIMARY ELEVATORS

FIGURE I-2

EFFECT OF GRADES

ON TOTAL COST OF PRIMARY ELEVATORS



This study will test the following hypotheses:

1. H_0 = There is no significant relationship between the <u>number of grades</u> of grain received by a primary elevator and average cost.

   H_1 = There is a significant relationship between the number of grades of grain received by a primary elevator and average cost.

2. H_0 = There is no significant relationship between the <u>number of grains</u> received by a primary elevator and average cost.

   H_1 = There is a significant relationship between the number of grains received by a primary elevator and average cost.

3. H_0 = There is no significant relationship between the volume of grain received by a primary elevator and average cost.

   H_1 = There is a significant relationship between the volume of grain received by a primary elevator and average cost.

4. H_0 = There is no significant relationship between the handling to capacity ratio of a primary elevator and average cost.

   H_1 = There is a significant relationship between the handling to capacity ratio of a primary elevator and

average cost.

5. H_0 = There is no significant relationship between the capacity of a primary elevator and average cost.

   H_1 = There is a significant relationship between the capacity of a primary elevator and average cost.

6. H_0 = There is no significant relationship between the age of a primary elevator and average cost.

   H_1 = There is a significant relationship between the age of a primary elevator and average cost.

E. Sources of Data

Data collected for this research study was obtained from two primary elevator companies located in western Canada. The data was personally collected from the head offices of the two co-operatives, Alberta Wheat Pool (head office in Calgary) and United Grain Growers (head office in Winnipeg). Communication between the author and the two co-operatives was established at the beginning of the study and then maintained throughout the research.

The volumes of grain handled and costs associated with primary elevator operations in Alberta comprise the bulk of the data obtained from the companies. Information on grain grading, rail car coordination and transportation activities specifically related to primary elevator operations were obtained from the head offices of the co-operatives, the

Canadian Grain Commission, the Canadian Wheat Board, the Canada Grains Council and the Winnipeg Commodity Exchange. All of these sources of information are based in Winnipeg except the Alberta Wheat Pool.

II. REVIEW OF RELATED STUDIES

Several studies[1] exist which analyze factors affecting the cost of handling and storing grain in primary elevators. A review of these primary elevator cost studies will serve to introduce some of the variables and the methodology used which are relevant to this cost study. These studies were basically interested in how costs of handling and storing grain at primary elevators were functionally related to such variables as elevator size, handling to capacity ratios, space utilization, and annex capacity. The studies made reference to the cost effect of handling a relatively large number of grades of grain; however, statistically this hypothesis was never fully tested and quantified.

Don Zasada and Om Tangri, from the University of Manitoba, conducted a study[2] designed to determine the average cost for the entire primary elevator industry over the period 1961/62 to 1963/64. In addition, the study analyzed the effect primary elevator size, space utilization and annex capacity had upon the cost-output relationship of elevators.

----

[1] Stephen W. Fuller, and Milton L. Manuel, Factors That Affect Country Grain Elevator Operation, Manhattan, Kansas: Agricultural Experiment Station, Bulletin 550, 1972. Also refer to Allan G. Sorflaten, Performance of the Country Grain Elevator Industry in Southwestern Ontario, Toronto: Farm Economics, Co-operatives and Statistics Branch, Ontario Department of Agriculture and Food, 1967.

[2] Don Zasada, and Om P. Tangri, An Analysis of Factors Affecting the Cost of Handling and Storing Grain in Manitoba Country Elevators, Winnipeg Faculty of Agriculture and Home Economics, University of Manitoba, Research Report 13, 1967, p. xiii.

The study of Zasada and Tangri concluded that "the most important single cost reducing factor in the grain elevator industry is the handling to capacity ratio."[1] Other findings of the study were:

1. The estimated total average cost of handling and storing grain by primary elevators was $3.41 per tonne (9.54 cents per bushel);
2. The estimated average cost per tonne of handling and storing grain at primary elevators decreases by $0.18 per tonne (0.5 cents per bushel) when annex to capacity ratio increases by ten per cent;and,
3. The estimated average cost per tonne of handling and storing grain decreases by $0.12 per tonne (0.33 cents per bushel) when the utilization of the primary elevator increases by ten per cent.[2]

The two independent variables, annex to capacity ratio and per cent space utilization did not reveal cost effects, which were felt by the authors, to be considered conclusive.[3]

In 1972 a study[4] by Fuller and Manuel, from Kansas State University, looked at various factors which affected

----

[1]Ibid., p.xiv. In their study, handling was defined as equal to the amount of grain placed into the elevator plus the amount of grain taken out of the elevator and the sum divided by two. Handling to capacity ratio, then, is handling divided by the rated capacity of the grain elevator. Turnover is used synonymously with this ratio.
[2]Ibid., p. xiv.
[3]Ibid., p. 88.
[4]Stephen W. Fuller, and Milton L. Manuel, Factors That Affect Country Grain Elevator Operation, Manhattan, Kansas: Agricultural Experiment Station, Bulletin 550, 1972.

country grain elevator efficiency. The study also looked at farm-to-elevator assembly costs; however, those results are not of particular relevance to this study. The factors listed which could influence the potential of a country elevator to handle increased volumes of grain were:

1. The length of harvesting season;
2. The capacity of the elevator;
3. The number of grains harvested in a region;
4. The extent to which grains compete for delivery at harvesting time; and,
5. The amount of available farm storage.[1]

In the study, these factors were not evaluated but only cited as factors which could affect elevator efficiency. However, the authors felt that the assortment of grains grown, and consequently grades, in a region and delivered to a primary elevator would influence elevator efficiency.

----

[1] Ibid., p. 17.

III. GRAIN GRADING

A. Function of Grading

One method of classifying the activities of marketing is to break the processes down into functions; exchange functions, physical functions, and facilitating functions.[1] This study focuses on the facilitating function of grading of grain (standardization). Standardization "involves the determination of basic measures or limits known as standards."[2] Grading then, is the classing of products into various categories established by standards. These groupings allow a narrower range of variation in characteristics (quality) within each group than is the case over the entire range of the commodity. Doll, Rhodes and West state, "grading may be defined as the sorting of a product into quality classification by a disinterested third party."[3]

To summarize, a standard defines the end-use properties (characteristics) deemed important and specifies the tolerances and methods used to measure these characteristics. Grades provide the classification system to use after the characteristics have been measured under the standard.

----

[1] R.L. Kohls, and W.D. Downey, Marketing of Agricultural Products, New York: Macmillan Publishing Co., Inc., 4th Edition, 1972, p. 20.
[2] Theodore N. Beckman, William R. Davidson, and W. Wayne Talarzyk, Marketing, New York: Ronald Press, 9th Edition, 1973, p. 500.
[3] John P. Doll, V. James Rhodes, and Jerry G. West, Economics of Agricultural Production, Markets, and Policy, Illinois: Richard D. Irwin, Inc., 1968, p. 397.

In general, for a grading system to be effective it should:

1. Be accepted by the trade;
2. Provide for a representative sample;
3. Be easy to evaluate;
4. Provide the evaluation in a short period of time;
5. Minimize the number of subjective factors to be considered;
6. Be relatively inexpensive from the standpoint of personnel, facilities and value of sample;
7. Measure factors that reflect value of product; and,
8. Reflect price differences in use value of the product.[1]

From these criteria for a grading system to be effective, it is shown that a compromise is necessary. The system should minimize the variation within each grade and minimize the number of subjective factors, thereby increasing the system's manageability. The system must reveal a representative sample yet at the same time minimize the cost in terms of time, effort and money needed for grading.

Even the "optimum system of grading"[2] proposed by Williams and Stout is a compromise between minimizing quality variation in each grade and the cost and inconvenience of doing so. Their requirements for an optimum

----

[1]Walter J. Wills, An Introduction to Grain Marketing, Illinois: Interstate Printers and Publishers, Inc., 1972, p. 35.

[2]Willard F. Williams and Thomas T. Stout, Economics of the Livestock-Meat Industry, New York: The Macmillan Company, 1964, p. 487.

grading system are:

1. Distinct or potentially separable demand functions, based on real rather than illusory differences in the product, exist;
2. In the absence of grades, consumers, marketing firms, or both cannot readily and accurately distinguish among significantly large differences in basic quality attributes or differences in combinations of these attributes;
3. Grade standards are established which provide the most effective basis possible for the distinct and separable demand functions of consumers and other buyers. This means:
    a. The variations in all economically important attributes can be measured precisely and all are employed as grade-determining criteria in the standards;
    b. The standards should separate units of the commodity into groups such that for each grade the within-grade variation in quality attributes, relative to the variation in that grade and each of the two possible adjacent grades, has been minimzed; and,
    c. The standards should maximize differences among grades in the range of quality attributes, which means that overlapping has been reduced to a minimum.

4. Any net reductions in costs are maximized or, alternatively, the value represented by the additional average price consumers or other buyers are willing to pay minus average (net) unit marketing costs is positive and maximized; and,
5. The system must be:
   a. Simple, easily, widely, and uniformly understood;
   b. Fixed and unchanging in a short-term sense, and at the same time, subject to change as warranted by longer-term considerations; and,
   c. Workable in the marketplace.[1]

"As within-grade variation is reduced through grade selection and increases in number of grades, a point eventually is reached where costs must rise significantly."[2] Thus, the optimum grading system is a system where marketing costs are minimized subject to maximizing the price buyers are willing to pay. This is commonly referred to as a "minimax" situation and "the optimum grade standard is the one that satisfies the conditions of the minimax."[3]

To summarize this section, grading attempts to fulfill two basic objectives. They are, "reductions in marketing costs and operational inefficiency, and improvements in

----

[1] Ibid., p. 486.
[2] Ibid., p. 487.
[3] For a detailed discussion of this concept see, S. Willard, Calculus for Business Economics, Edmonton: Department of Mathematics, University of Alberta, 1973, Chapter 9.

pricing accuracy."[1] The optimum grading system is a compromise between these two objectives.

B. Canadian Grain Grading

Grain grades are an attempt to standarize grain, and are an important marketing tool because they provide the basis of communication between buyers and sellers.[2] Canadian grain grades are oriented toward communication within wholesale trading, not toward the final consumers as are grades for meat or eggs. Grains are primarily used as raw material inputs to the production of food products. Flour, meat and eggs are examples of food products requiring grain as an input at some stage of their production. Within wholesale markets, grades and standards for grain are utilized by producers, handlers, merchants and processors of grain:

> Average prices received by producers are affected by the degree to which grain supplied by them meets the needs of processors. Effective standards enable the market to inform producers of the quality needed for efficient processing. Handlers and merchants use standards for communicating, contracting and inventory control... Processors use standards to identify grain having potential for meeting their requirements.[3]

----

[1]Willard F. Williams and Thomas T. Stout, Economics of the Livestock-Meat Industry, New York: The Macmillan Company, 1964, p. 467.

[2]Federal Grain Inspection Service, Report on the Adequacy of Existing Official U.S. Standards for Grain, Washington, D.C.: U.S.D.A., 1979, p. 4.

[3]*Ibid*., p. 4.

One of the earliest pieces of grain legislation was the General Inspection Act, passed by the federal government in 1886. This Act was the beginning of the use of grade definitions for western and eastern Canada. Use of grain inspectors and approved standard samples for the various grades were also part of the Act.

Grain, in its botanical sense, includes the seeds of all cereal plants. Oilseeds (such as rapeseed or flaxseed) and the seeds of leguminous plants (peas, beans) are also called grains. In Canada these seeds share similar marketing facilities and when the term grain is used it means cereal, oil bearing and leguminous seeds.

The Canada Grain Act defines grain as, "any seed named in Schedule I or designated by regulation as a grain for the purposes of this Act."[1] Schedule I refers to the statutory grades of grain and is subject to amendment by Order in Council from Parliament. The legal meaning of the term grain, then, is any seed so named by the Canada Grain Act or by Order in Council.

Grade definitions and grade names are set out in Schedule I of the Canada Grain Act and are separated into grades of Western grain and grades of Eastern grain.[2] The grading system is designed to segregate the relative

----

[1]Canada Grain Act, Statutes of Canada 1970, c. 7, s. 2(16). Refer to Appendix C for examples.

[2]Western Division means all that part of Canada lying west of the meridian passing through the eastern boundary of the City of Thunder Bay, including the whole of the Province of Manitoba. Western grain is any grain grown in the Western Division.

qualities of each load of grain, keeping in mind the final usage of the grain. Grade refers to a name and number assigned to a grain - for example, Number 1 Canadian Western Red Springs (No. 1 CWRS). Examples of grains would be wheat, barley, flax, and mustard.

There are several common grading factors being employed by various countries in 1979.[1] Test weight, moisture and protein are three of these factors. Each of these factors can be measured through the use of standardized methods and equipment. Visual grading factors, requiring varying degrees of subjectivity, are varietal identification, vitreousness, soundness and impurities.

Grading factors may be grouped into three general categories:

1. The first group of factors affect the yield of the primary product, i.e. bread flour, semolina, malt or oil. Such factors are mainly physical. In all cases it is the endosperm material from cereals and oilseeds that is wanted; therefore, such factors as shrunken or small immature kernels will have important effects on product yield. The presence of foreign material will have a similar effect;
2. The second group of factors affect the utilization or processing quality of the product. These are generally of two types: those that are external such as mold mildew, black point, etc., and do little if any damage to the endosperm, and those that cause internal changes such as immaturity, sprouting and frost damage. Inferior varieties or other classes of grain also fall into this second category; and,
3. The third group of factors affect the edibility of the end product and include ergot, mercury treated grain, and pesticide residue.[2]

----

[1]These grading factors were derived from the various systems in effect in Australia, Argentina, Canada, France and United States.
[2]Canada Grains Council, Grain Grading Report, Winnipeg: C.G.C., 1979, p. 4.

The Canadian system uses test weight, variety, soundness and foreign material as the major grading factors. "Under the system, grain is evaluated on the basis of visual assessment of factors related to quality, and grades are assigned in accordance with specifications established under the Canada Grain Act."[1]

There are four classes of Canadian grain and grain screenings established by law in Canada. They are as follows:

1. Class I Grades (Statutory);
2. Class II Grades (Special Grades);
3. Class III Grades (Off Grades); and,
4. Class IV Grades (Screenings).[2]

Class I grades include the statutory grades which segregate the quality of the various types of grain.

Class II grades include special grades, not included in the statutory grades and which are established by regulation. When adverse weather conditions result in the production of shrunken, lightweight but otherwise sound grain, then special grades may be established. This class also includes new varieties of grain.

Class III grades are off grades of grain which cannot be graded into the statutory or special grades because of

----

[1] Ibid, p. 17. For an example of the tolerances in use for Red Spring Wheat refer to Appendix B. Schedule I of the Canada Grain Act gives tolerances for all statutory grades of grain.
[2] Canadian Grain Commission, Official Grain Grading Guide, Winnipeg: C.G.C., 1979, p. 1. See Appendix C for a list of the official grade names of these grades.

condition or admixture. Therefore, this class includes tough, damp, moist and wet grain and, "rejected grades for reasons such as drying odour, admixture, heating, stones, fireburnt or ergot."[1]

Class IV grades include machine separated screenings, referred to as dockage. The grain may be shrunken or broken yet nutritionally it is still a good manufactured feed source.

Within these four classes exist thirty-six identifiable grains and grain byproducts with grades defined in the Canada Grain Act, Regulations and Orders.[2] Approximately 159 separately defined grades exist within these 36 grains and when possible off grades are added, the total number of grades can reach one thousand. In a normal crop year, the Inspection Division of the Canadian Grain Commission "...issues grade certificates identifying as many as 800 different grades of grain..."[3]

Grades are established, amended or deleted by order of the Governor General of Canada. Recommendations for grades are made to the Canadian Grain Commission by an official committee on grain standards. If agreed to by the Canadian Grain Commission, grades may be implemented directly, otherwise, the recommendations are presented to the government for final acceptance. Such changes may be the addition or deletion of grains or grades, or some variation

----

[1]Charles F. Wilson, Grain Marketing in Canada, Winnipeg: Canadian International Grains Institute, 1979, p. 15.
[2]Ibid., p. 17.
[3]Ibid., p. 18.

of a standard of quality such as test weight or per cent of foreign material.

Under the Canadian Grain Commission there exists two grain standards committees, known as the Western Standards Committee and the Eastern Standards Committee. The purpose of the committees is to make recommendations on specifications for grain grades and to determine and recommend primary and export standard samples of grain.

The collection of these samples is made as soon as possible in the crop year.[1] Representative samples of the crop from both divisions are then used to depict each grade of grain existing in Schedule I. If a current grade sample is not available, a previously approved grade sample of another year may be used if thought to be representative. Further information is collected on milling, baking and other qualities of the grade samples, where applicable, before a meeting of each grain standards committee takes place. The two committees from their respective divisions examine the samples of grain collected and:

1. Select and recommend to the Canadian Grain Commission samples of each grade of grain existing in Schedule I that represent the minimum of that grade; and,
2. Recommend to the Canadian Grain Commission names and specifications for other grades that should be established for the current crop year and which

----

[1] A crop year is the period commencing August 1 in any year and ending on July 31 in the next year following.

represent the minimum of that grade.[1]

As noted previously, two distinct types of standard samples are prepared by the Canadian Grain Commission, primary standard samples and export standard samples. The primary standard sample is a visual example of the minimum quality factors recommended for a particular grade.[2] The Canadian Grain Commission, as well as private grain inspectors, use the samples as a guide to establishing grades. Use of primary standard samples as a minimum quality of a grade delivered to primary elevators also helps assure producers of an accurate grade assessment.

In addition to primary standard samples, the Western Standards Committee makes recommendations for export standard samples on grades of western red spring wheat, western amber durum wheat and any other grades of western grain that are likely to be sold for export. Export standard samples are only prepared for western Canadian grains. Export standard samples represent the average quality of each grade to be exported. Small sample bags are provided to grain importers and customers as assurance of this average minimum quality. Overall quality is always considered with export standard grades. This means that while a grain may be slightly below the requirements in one factor, other factors are above the requirements, making the overall quality equal

----

[1]Canada Grain Act, Statutes of Canada 1970, c. 7, s. 19(2).
[2]An example of a specific grading factor would be the frost damage in wheat. In this instance, the official sample shows the maximum that can be present yet still be within the grade.

or better than the export standard sample.

Sample preparation is similar to that of primary standard samples; however, additional end use quality tests are performed. Bread wheats are tested for milling and baking qualities and durum wheats are analyzed for macaroni quality before the Grain Standards Committee grants authorization for the use of the samples.

To summarize, primary standard samples represent the minimum acceptable quality for a grade, and are used as guides to grading grain primarily before and on receipt at terminal elevators.[1] Export standard samples refer to western Canadian grain only, and represent the average acceptable quality for a grade. Export standard samples are established for most of the basic grades of wheat and govern shipments out of terminal, transfer and process elevators.[2]

----

[1]Terminal elevators receive grain upon or after official inspection and weighing of the grain and the cleaning, storing and treating of the grain before it is moved forward.

[2]A transfer elevator's principle use is the transfer of grain already officially inspected and weighed at another elevator. A process elevator receives and stores grain for direct manufacture or processing into other products.

IV. PRIMARY ELEVATOR SYSTEM

The principal function of a primary elevator is, "to receive grain directly from producers for either or both storage and forwarding."[1] A historical coverage of how this function developed within the primary elevator system in western Canada will be presented first. This section will be followed by a detailed description of the operations and procedures of the primary elevator system with respect to the overall grain handling and transportation system.

With the completion of the Canadian Pacific transcontinental railway in 1886, new lands were opened up to agricultural settlement. Canada was beginning to establish herself as an exporter of wheat. In accordance with the increased amount of grain produced in the country, primary elevator companies were changing and improving their facilities to keep pace.[2]

The first primary elevator in Canada was built at Gretna, Manitoba in 1881. The only facilities that existed before 1881 were flat warehouses; wooden structures at country sidings. Grain was unloaded in bags from farm wagons and when a sufficient quantity of grain was gathered, a rail car was spotted along side the warehouse for loading. No machinery existed with these warehouses, so the loading of boxcars was a slow process.

----

[1]Canada Grain Act, Statutes of Canada 1970, c. 7, s. 2(36).
[2]For a summary of the beginnings of the primary elevator system refer to, Canada Grains Council, Grain Handling and Transportation, State of the Industry, Winnipeg: C.G.C., 1973.

By 1875 elevators were proving themselves in the United States as a means of efficiently moving grain. Canadian railways recognized the advantages of the primary elevator system to their operations and as a consequence, encouraged the construction of primary elevators. Railways offered free elevator sites, special privileges and refused to accept grain through flat warehouses or direct from farmers' wagons. While these steps served to improve grain handling and transportation, many farmers were placed at the mercy of the grain handling companies because of decreased competition.[1]

Four hundred and forty seven elevators existed across the prairies by 1900. Prior to 1900 the main primary elevator companies were Ogilvie Milling Company, Lake of the Woods Milling Company and the Northern Elevator Company.[2] The Northern Elevator Company was the first elevator company to construct a chain (line) of elevators. At that time elevator revenues came from buying and selling grain and handling tariffs.[3]

----

[1]These problems and controversies were looked into by a Royal Commission in 1899. Their recommendation led to the passage of the Manitoba Grain Act in 1900, which made provision for regulation of the grain trade. Producers' rights and privileges were provided for in this Act, known as the producers' Magna Carta.

[2]Northern Elevator Company later became National Grain Limited which was subsequently purchased in 1975 by Cargill Grain Co.

[3]The handling tariff of approximately 1.5 cents per bushel was levied on the producer (56 cents per tonne).

A. Formation of the Grain Co-operatives

In 1900, three so called "line" elevator companies existed which were increasingly gaining control of the local, country grain markets. In 1906 the Grain Growers Grain Co. was formed in order to offer competition to the line elevator companies.[1]

Fluctuating prices for grain and the uncertainty of the open market system during the early 1900s led producers to call for methods of price pooling and market stablization. In 1919, following 10 days of disbandment of the Board of Grain Supervisors and a return to futures trading at the Winnipeg Commodity Exchange, the first Canadian Wheat Board was established in response to the centralized and government control of grain buying which had developed in importing countries.

The Board marketed the 1919/20 crop and then re-established the futures trading again. From 1920 to 1924, "...almost continuous price declines occurred...";[2] however, between 1917 and 1920 relatively high prices were being paid for wheat. This condition was related more to world wheat conditions prevailing at the time rather than the actions and effectiveness of the Canadian Wheat Board. In any event, "the high prices of the 1917-20 period became associated with the existence of centralized selling, and farmer

----

[1]The Grain Growers Grain Company became United Grain Growers in 1917, making it the oldest producer-owned company.
[2]Canada Grains Council, <u>State of the Industry</u>, p. 13.

organizations pressed for continuance of the C.W.B."[1]

When farm organizations failed to gain C.W.B. continuance they formed co-operative price pools. The Alberta Wheat Pool was formed in 1923 and the Saskatchewan Wheat Pool and Manitoba Pool Elevators were formed in 1924. The formation of these Pool organizations were confined to the marketing of wheat.

B. Development of the Primary Elevator System to 1979

The primary elevator system has been in a consolidation process for the last ten years. Some consolidation has resulted from the closure of obsolete primary elevators. Consolidation has also occurred, "where two firms make arrangements so that one could consolidate an elevator of the second company with its own facilities."[2] A single manager then runs the two elevators as an operating unit, while the second firm takes over a similar operation at another location.[3] These factors have contributed to a lessening of competing companies per delivery point. The choice a producer now has as to which company he will patronize has altered from "competition at a point to

----

[1] Ibid., p. 13.
[2] Booz-Allen and Hamilton Inc., Grain Transportation and Handling in Western Canada: Technical Report, Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.) Chapter VI, p. 11.
[3] This process is known as a saw-off.

competition between points."[1]

From 1971 through 1978 the total rail line mileage had not changed significantly; total mileage decreased by 5%.[2] However, the decline in the number of primary elevators over this same time period had been more than 26%.[3] The total number of primary elevators has declined from a peak of more than 5,700 in 1934 to 3,528 in 1978.[4] Numbers of elevators have been decreasing yet average elevator size has been increasing, creating a net increase in total storage capacity (Figure IV-1). Total storage capacity has increased from over 5,400,000 tonnes in 1934 to a peak of 11,167,000 tonnes in 1970. The 1979 total storage was 9,052,740.[5]

While numbers of primary elevators have been declining, the average size of these elevators have been increasing. More emphasis has been put on high throughput facilities as evidenced by construction of Alberta Wheat Pool's 5,580 tonne capacity slope bin at Magrath, Alberta. In 1935 the average elevator capacity was 930 tonnes but by 1979 this average had increased to 3,810 tonnes.

----

[1]Canada Grains Council, State of the Industry, p. 152. As of August 1, 1966 there was an average of 2.09 companies per station. By 1978 there was an average of 1.61 companies per station.

[2]Booz-Allen and Hamilton Inc., Grain Transportation and Handling in Western Canada: Technical Report, Bethesda: Booz-Allen and Hamilton., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.) Chapter VI, p. 8.

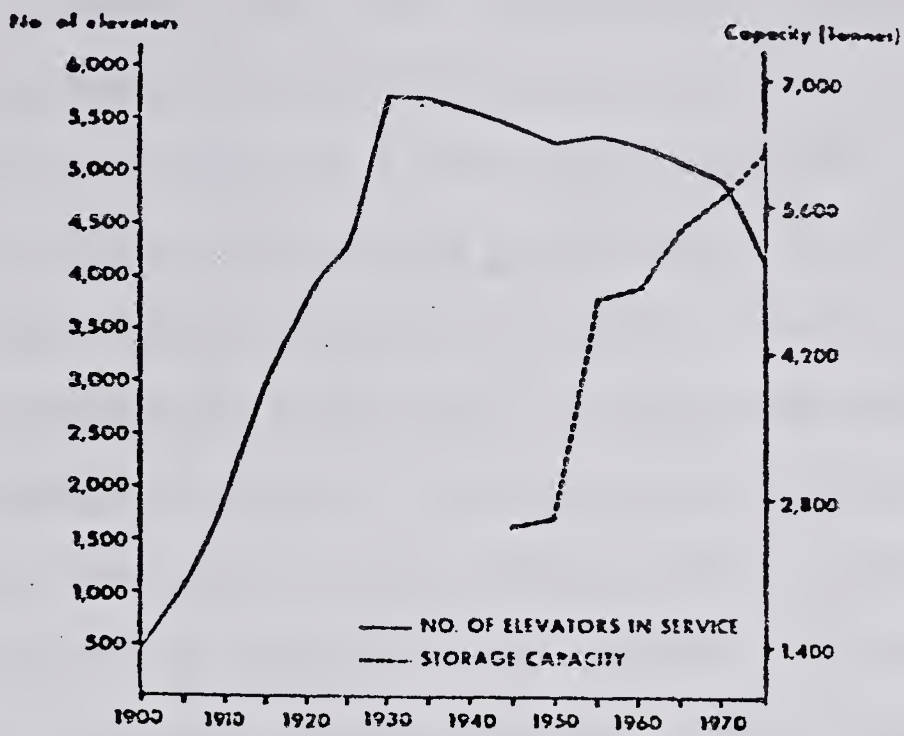
[3]Canadian Grain Commission, Grain Elevators in Canada, Winnipeg: C.G.C., Various Issues.

[4]Appendix D.

[5]Appendix D.

FIGURE IV-1.

RELATIONSHIP BETWEEN NUMBER OF ELEVATORS AND DELIVERY POINT CAPACITY IN THE PRIMARY ELEVATOR SYSTEM.



Source: Canadian Grain Commission, Grain Elevators in Canada, Winnipeg: C.G.C., Various Issues.

There are several factors which have played a part in the trend toward consolidation of the primary elevator system.[1] General cost escalation has been a major factor. Increases have come from elevator labour costs and the need for large amounts of capital to rebuild and replace obsolete facilities. New scales and elevator legs are required at many older elevators built before 1940. These older elevators are of a relatively small size, making them

----

[1] Many of these comments and observations come from the Planning and Construction Departments of the Alberta Wheat Pool and United Grain Growers.

uneconomically viable in 1980.

Increased construction costs have raised the investment price of new elevators. Construction costs from Alberta Wheat Pool, Pioneer Grain Ltd. and United Grain Growers reveal an average price of $160-170 per tonne for a wooden structure built in 1979. A 4,000 tonne capacity primary elevator would cost approximately $660,000 in 1979. In order to finance such large outlays of capital, large volumes of grain must be handled. Companies are building high throughput design elevators and then drawing grain from a larger production area in order to meet this goal.

Improvements in the rural road network have also contributed to elevator consolidation. These conditions have made it possible for producers to use larger trucks over longer distances.

Regulations by the Canadian Commission in terms of maximum tariff rates for handling services and the existence and philosophy of the Co-operatives, coupled with producer attitudes about consolidation have had the effect of deferring primary elevator consolidation.

C. The 1979 Primary Elevator System

The Canadian primary elevator system in 1979 consisted of 3,528 licensed elevators located at 1,351 railway shipping points.[1] The Province of Saskatchewan has 1,915 elevators, or 54% of all primary elevators, followed by

----

[1] Appendix F.

Alberta with 1,174 (33%), Manitoba with 446 (13%) and B.C. with 22 (less than 1%).

In 1979 six of the largest companies owned 95.4% of the total number of elevators. Within these six, three Pools (Alberta Wheat Pool, Saskatchewan Wheat Pool and Manitoba Pool Elevators) owned 58.7% of the total number of elevators.

In terms of licensed storage capacity, in 1979 the Canadian primary elevator system had a total of 9,052,740 tonnes.[1] The Province of Saskatchewan has the largest storage capacity with 4,673,700 tonnes or 52% of the total storage capacity. Alberta is second with 3,105,730 (34%), followed by Manitoba, 1,117,150 (12%) and B.C. with 96,160 (1%).

Preliminary estimates indicate a total of 22,961,000 tonnes will be marketed through primary elevators in western Canada for the 1978/79 crop year. The ten year average according to the Canada Grains Council is 20,719,000 tonnes.[2]

In Alberta, there are thirteen companies which operate licensed primary elevators. From 1973 to 1979, the total number of these elevators and the total licensed storage capacity have been declining.[3] There were 1,390 elevators with a total storage capacity of 3,464,000 tonnes in Alberta in 1973. By August 1, 1979 these totals had declined to 1,174 elevators and 3,105,730 tonnes. However, as is the

----

[1] Appendix D.
[2] Canada Grains Council, Canadian Grains Industry: Statistical Handbook, 79, Winnipeg: C.G.C., 1979, p. 181.
[3] Appendix E,F.

trend over all of western Canada, primary elevators are becoming larger. Alberta average primary elevator storage capacity in 1979 was approximately 2,645 tonnes, slightly above the Western Division average of 2,565 tonnes.

Alberta Wheat Pool and United Grain Growers are the dominant firms in Alberta with 60% and 23% of the primary elevators respectively.[1] A comparative list of other primary elevator companies includes a mixture of privately-owned and producer-owned companies.[2] The Manitoba, Saskatchewan and Alberta Pools are producer-owned co-operatives. The co-operatives jointly own XCAN Grain Limited, a grain sales agency for export markets.

United Grain Growers is not considered a producer co-operative in the strict sense, since any investor can buy Class A shares. However, Class B shares carry the voting rights and are restricted to grain producers only, with each producer limited to the number of shares he may own.[3] In terms of voting rights U.G.G. is identical to that of other co-operatives.

Examples of privately incorporated grain companies are Cargill Grain Co. Ltd., Continental Grain Co. Ltd., Parrish & Heimbecker Ltd., and Pioneer Grain Co. Ltd. Pioneer Grain Company Limited, a wholly owned subsidiary of James Richardson & Sons Ltd., N.M. Paterson & Sons Ltd., and Parrish & Heimbecker Ltd., can be traced as far back as

----

[1]Appendix G.
[2]Appendix H.
[3]Personal conversation with A.M. Runciman, President, United Grain Growers.

1893. The most recent owner of primary elevator facilities on a large scale is an American company, Cargill Grain Company Limited.

D. Operations of Primary Elevators[1]

Any elevator in which grain is received from farmers, stored and loaded out before it has been officially graded, is called a primary elevator. This section will detail the receival, storage and loading operations, along with any related procedures which occur at the primary elevator level.

Receiving of Grain - Operators of every licensed primary elevator must receive all grain lawfully offered for which available storage space exists.[2]

When a truck load of grain enters the elevator it is driven onto a weigh scale and the gross weight is recorded. The scales can vary from 10 tonne limits, with 5.5 metre platforms in older elevators to 60 tonne capacity, 18 metre platforms in new elevators. A pit is situated beneath the grated platform with capacities in new elevators of 18 tonnes. When the grain has been unloaded, the empty truck is weighed. The difference between the weight of the empty truck and the full truck is the weight of the grain unloaded. This figure is then recorded on a delivery slip.

----

[1]A cross-section of a primary elevator is depicted in Appendix I.

[2]For restrictions referring to receipt of grain into elevators see, Canada Grain Act, Statutes of Canada 1970, c. 7, s.45.

While the grain was being unloaded a sample of the grain was taken in order to determine the proper grade and dockage.[1] To determine dockage, the elevator agent will take the 500 gram "subsample" and put it through a dockage tester. This removes foreign material[2] such as weed seeds and chaff. The clean grain is then re-weighed in order to determine a dockage percentage. This percentage is used as the measure for the entire truckload received. The elevator manager (a person who works for the company; the company acting as an agent for the Canadian Wheat Board) will also weigh the sample and determine its moisture content before assigning the grade.

As the elevator manager now has an indication of the grade delivered he can elevate the grain via a leg to a selected bin. New elevators have what are known as double legs, and can maintain a 140 to 170 tonne/hr. capacity. The legs are referred to as double legs because one leg is for receiving and one for loading rail cars, both functions can be performed simultaneously. Older structures have only one leg to perform both functions, consequently they can be less efficient.

If the person offering the grain and the elevator manager agree on the grade of grain and the dockage, the

----

[1] Dockage is material that can be removed from grain by the use of approved cleaning equipment (with a few specific exceptions) in order that the grain can be assessed to the grade for which it qualifies. Dockage is expressed as a per cent of the gross weight of the delivered grain, to the nearest .5%.

[2] Foreign material is material other than grain of the same class which remains in the sample after cleaning.

operator issues a cash purchase ticket[1] or elevator receipt. The receipt states the grade of grain and the dockage of the grain.

When disagreement exists as to grade or dockage of grain delivered to a primary elevator, the producer may request arbitration by sample submission to an inspection office of the Commission. There the grade and dockage of the sample, is officially determined. If dissatisfaction still exists, the Chief Grain Inspector (Director of the Inspection Division) may be requested to review the sample, his decision being final.

Disagreement may also occur if the identity of specially binned grain[2] at primary elevators has not been preserved. For example, a producer may ship malting barley, but when the malt plant or terminal elevator receives the grain, it is turned down. Producers may then request the Chief Grain Inspector of the Canadian Grain Commissson to compare the official unload sample with the sample taken when the grain was specially binned at the primary elevator. If it is found that identity was not preserved, the Commission may direct the elevator manager to make a settlement with the producer.

<u>Storage</u> <u>of</u> <u>Grain</u> - Most elevators will have at least 20

----

[1]A cash purchase ticket is a document issued for grain delivered to a primary elevator. This constitutes evidence of the purchase of grain by the elevator operator and, it entitles the holder of the ticket to payment by the operator for the grain. The purchase price is stated on the ticket.
[2]Special binning is the storing of grain under contract for the purpose of preserving the identity of the grain.

bins, each with a minimum of 60 tonne storage capacity, in order to keep grades segregated.

Many areas of Western Canada produce at least the six major grains and of these grains, many grades can exist. The variability in crops grown is the result of variable land qualities, moisture, frost, growing season, among others. Candlish states:

> In a predominantly wheat growing district in the south or central part of the prairies relatively few separate bins are required compared with a northern area where all of the various grains may be grown, and harvest conditions normally result in many grades and conditions of grain.[1]

Booz-Allen[2] examined stock sheets of 198 primary elevators to determine the numbers of grain and grade configurations handled (Table IV-1). This chart shows the median primary elevator to handle between 11 to 15 grades of grain which must be binned separately.

"Any grain that the elevator manager has purchased for cash may be binned with any other grain of the same class, regardless of grade."[3] Elevator managers proficient in determining grades of grain and blending different quality grades together will make better utilization of available storage space and should therefore have increased profits.

----

[1]J. Candlish, Primary Elevator Operations in Canada, Winnipeg: United Grain Growers, Date Uncited, p. 6.
[2]Booz-Allen and Hamilton Inc., Grain Transportation and Handling in Western Canada: Technical Report, Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.) Chapter VI, p. 11.
[3]Charles F. Wilson, Grain Marketing in Canada, Winnipeg: Canadian International Grains Institute, 1979, p. 22.

TABLE IV-1.

NUMBER OF GRADES CARRIED IN SAMPLE OF PRIMARY ELEVATORS

NUMBER OF GRADES	ALTA.		SASK.		MAN.		TOTAL		PER CENT
< 5	8	8	0	0	0	0	8	0	4%
5 to 10	19	27	21	21	7	7	47	55	28%
11 to 15	24	51	36	57	9	16	69	124	62%
16 to 20	13	64	27	84	10	26	50	174	77%
21 to 25	3	67	13	97	5	31	21	195	93%
26 or more	0	67	2	99	1	32	3	198	100%
	--		--		--		---		
Total Elevators in Sample	67		99		32		198		

Source: Booz-Allen and Hamilton Inc., Grain Transportation and Handling in Western Canada: Technical Report, Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.) Chapter VI, p.15.

However, if an elevator manager undergrades his receipts the effect can be an eventual loss of patronage to his elevator. This latitude of mixing grades does not exist at terminal elevators; inspected grain must be of the same grade in order to share the same bin.[1]

Loading Box cars, Hopper cars and Trucks - Grain to be loaded is first weighed before it is moved to a pit. There a leg elevates the grain which is then distributed via a spout to a hopper car, box car or truck. New elevators are automated; these functions are programmed to a particular load so that when the required amount of grain has been

----

[1]Mixing of wheat in grades Extra No. 1 C.W., No. 1 C.W., Extra No. 2 C.W. and No. 2 C.W. red spring is not permitted. For exceptions to this law see, Canadian Grain Act, Statutes of Canada 1970, c. 7, s. 59.

loaded the facilities shut off.

Off track siding is required to "spot" the rail cars needed to be filled. New, larger elevators are seldom built without the capacity of at least a ten car spot.

Weights and samples of the contents of the cars or liners are kept with the grain, as required by the Canadian Grain Commission.

Overages and Shortages - Canada Grain Regulations require each operator of a primary elevator to weighover[1] grain and products, including screenings, at least every three years unless otherwise directed.[2] Also, as a matter of practice, a weighover is done whenever a change in elevator management staff occurs.

Board grain (purchased for the Canadian Wheat Board) and non-Board grain (grain purchased by elevator agents of the Canadian Wheat Board but not for the C.W.B.) are weighed over but done separately. An underage or overage is determined for each grade in order to arrive at a net figure. Some grades may be over while some may be under but it is the net figure of all grades that must be within the Canadian Grain Commission's tolerance. Section 65(2) of the regulations[3] stipulate a maximum tolerance of grain to be one sixteenth of one per cent of the total quantity received

----

[1]A weighover is the weighing and inspection of all grain of any grade in an elevator for the purpose of determining the amount of stock. A stock report is then sent to the Canadian Grain Commission.

[2]A weighover may not be called for if the elevator is plugged, as sufficient working space is required to do this check.

[3]Canada Gazette, Part II, Vol. 105, No. 6, 24-3-71.

since the last weighover. Failure to meet the performance standard may lead to the loss of his licence. Overages and shortages are the responsibility of the operating company.[1]

E. Marketing Options Available to Producers

Producers, as prescribed by the Canada Grain Act, can market grain via primary, process, interior terminal elevators and producer cars.[2] As well producers face other marketing options for their grain which include, sale to unlicensed elevators (feed mills, distilleries), feed lots, or the feeding of grain to their own livestock and poultry.

This section will describe the options open to a producer at the primary elevator level. A producer can accept: a cash ticket, a deferred cash purchase ticket, an interim storage receipt, a graded storage receipt, an identity-preserved special bin receipt, or a cleaning or drying receipt.

Cash Purchase Tickets - When board grain is delivered the initial payment made for the grade agreed upon is basis in store Thunder Bay or Vancouver less transportation and elevation costs. Therefore the delivery point is a factor in the price the Board pays. When this net figure ($/tonne) is multiplied by the net tonnage delivered a gross payment is

----

[1]Personal conversation with A.G. Evans, Supervisor, Cut-offs & Shipments, Alberta Wheat Pool and Allen Boes of United Grain Grower's head office.

[2]An excellent report on producer cars is contained in, Producer Car Study Committee, (S. Williams, Chariman), Report of the Producer Car Committee, 1979. (Prepared for the Canadian Grain Commission.)

established. From this figure may be subtracted the voluntary 2% Western Grains Stabilization Plan contribution and any cash advances against farm stored grain made by the Canadian Wheat Board. The final net amount is entered in the elevator books and a ticket issued and signed by the agent. This ticket is a fully negotiable document known as a cash purchase ticket and once issued, weight, dockage and grade are final.[1]

Non-Board grain delivered to a country elevator is priced on the basis of the futures market and according to the amount of competition between other elevator companies in a particular delivery area.

Graded Storage Receipts - If a producer does not wish to sell the grain delivered immediately, a graded storage receipt can be issued. The grade, weight, dockage and moisture content are still taken and recorded; however, the identity of the grain is not preserved; it is binned with grain of similar grade and quality. The producer then pays storage on the grain until he chooses to sell, at which time the graded storage ticket is exchanged for a cash purchase ticket. Producers may take this type of storage because this grain is insured, it is secure against loss by fire, theft or contamination and it can be sold immediately as it has already been delivered.

----

[1] A deferred cash purchase ticket can be issued which is post dated to the next calendar year. Producers under the cash method of paying income tax can then defer payment until the following year.

Interim Elevator Receipts - If a producer is not satisfied with the grade, percent dockage or quality assessment of the delivered grain made by the elevator manager, an interim elevator receipt can be asked for. A 750 gram sample is sent to the nearest Inspection Office of the Canadian Grain Commission. When a decision is reached the interim receipt is exchanged for either a cash ticket or a graded storage receipt.

Special Bin Elevator Receipts - Special bin receipts are used when a producer wants to preserve the identity of his grain. It is of common occurrence when shipping selected oats or barley, or a consigned car basis, or new varieties of grain grown under contract.[1]

If the manager of the elevator has sufficient room to accept a special bin receipt, then a sample is taken. The sample is sealed and locked by the producer in a cabinet provided by the elevator. A special bin receipt is then issued.

Cleaning and Drying Receipts - Few primary elevators are equipped with adequate facilities to clean and dry grain. Where an elevator is equipped with these facilities grain delivered is cleaned and/or dried before grading takes place. The grain, and screenings if the producer wants them, can then be taken from the elevator or the owner can exchange the cleaning and/or drying receipt for a cash ticket or storage receipt.

----
[1]Charles F. Wilson, _Grain Marketing in Canada_, Winnipeg: Canadian International Grains Institute, 1979, p. 293.

F. Primary Elevator Revenues

Primary elevators have five major sources of revenue:

1. Earnings arising from the resale of grain purchased from farmers;
2. Elevation and handling charges;
3. Storage charges;
4. Additional services such as drying and cleaning; and,
5. Sale of fertilizers, chemicals, feed, seed and other farm production supplies.

Elevation charges exist for all grain received into primary elevators. However, storage of unsold grain is free of charge for an initial ten day period.[1]

Elevators may provide additional services for dockage removal, custom cleaning or custom drying. However not all primary elevators are equipped to handle these additional services.

Elevator charges are deducted (as well as freight charges) when grain is sold on a cash ticket in order to arrive at a net price. If storage, cleaning or drying charges are involved, the deduction for these is made when the grain is shipped.

Primary elevator companies have also integrated their operations into other grain marketing activities. Such activities include terminal elevator operations at Thunder Bay and Vancouver. Prior to primary elevator company

----

[1]See Appendix J for a list of the maximum elevator tariff charges.

terminal involvement railways and then the federal government undertook the terminal functions.

Other areas of expansion include domestic and export merchandising of grain processing, milling, oilseed crushing, livestock marketing, farm supply sales and printing and publishing.[1]

---

[1] Ibid., p. 25.

V. DATA COLLECTION, ANALYSIS AND EMPIRICAL RESULTS

A. Source and Collection of Data

This report examines the cost of handling and storing grain in Alberta primary grain elevators[1] and the effect of the domestic grain grading system on these costs. The period which this study covers is the crop years 1975/76, 1976/77, 1977/78 and 1978/79 with respect to Alberta Wheat Pool data and crop years 1976/77, 1977/78 and 1978/79 with respect to United Grain Grower's data. A longer time period could not have been assembled easily as data prior to the periods mentioned were not kept on computer tapes; retrieval of earlier data would have to be done manually. However, this period still provides a representative cross-section of average and above average producers' marketings through western Canadian licensed primary elevators based on a ten year average.[2] The 1977/78 and 1978/79 crop years are the periods of above average producers' marketings through licensed primary elevators. Table V-1 depicts the sample distribution between the two companies over the four crop years.

As shown in Table V-1 the bulk of the grain handling

----

[1]Elevators were broken down by region in the following data analysis in order to study and locational differences which may exist. One such region was the Peace River District and includes five elevators in the Province of British Columbia. Refer to Appendix L for a regional map.
[2]Canada Grains Council, Canadian Grains Industry: Statistical Handbook, 79, Winnipeg: C.G.C., 1979, pp. 179-180.

TABLE V-1

NUMBER OF ELEVATORS IN SAMPLE BY COMPANY

	1975/76	1976/77	1977/78	1978/79	Period
A.W.P.	153	153	152	149	607
U.G.G.	0	12	12	12	36
TOTAL	153	165	164	161	643

and cost data came from Alberta Wheat Pool. Of the 153 elevators in the sample for 1975/76 all were Alberta Wheat Pool's elevators. United Grain Grower's elevators were represented in the final three years. For the 1977/78 crop year one Pool elevator was dropped and for the 1978/79 crop year three more Pool elevators were dropped from the sample. One was converted to bulk fertilizer handling while the others were taken up as an operating unit of another elevator and the accounting records could then not be separated, therefore they were dropped. For 1978/79 the 161 elevators in the sample represented 21% of the total operating units in Alberta. The total number of observations made over the four years was 643. Any referral to period averages (1975/76-1978/79) are with respect to the 643 observations.

The sample was selected by first limiting the choice to two major grain elevator companies in Alberta; Alberta Wheat Pool and United Grain Growers. Limiting the choice was done to facilitate data collection and to keep to a minimum the effects of different accounting methods.

The second criterion of sample selection came from the method of management used at a particular elevator site. Only elevator operating units which had one manager directly in charge of one elevator could be used as grain handled and costs incurred were accounted for only in terms of manager units. One manager could run four or more elevators yet costs were not kept separate or specific to a particular elevator; meaning costs would have to be allocated over a particular quantity of grain handled. Rather than allocate costs, only elevators with one manager were choosen for the sample.

Elevator Costs - The primary elevator system as it existed in Alberta during the late 1970s comprised many different sizes, ages and types of elevators. Wooden elevators built as far back as 1903 and having a capacity of under 1,000 tonnes exist and are still operational. At the other end of the elevator system exists concrete structures with computer operated facilities and a capacity approaching 8,000 tonnes. The overall cost structure of the industry is very difficult to study because of this wide variation in facility characteristics.

The cost data of the two companies were collected from the year-end general ledger tapes at the head office of Alberta Wheat Pool and from the year-end profit-loss statements at the head office of United Grain Growers. Figure V-1 is a flowchart and outline of how the cost data were handled.

FIGURE V-1
Outline of the Construction of the
Elevator Cost Study

STEP 1: Take variable costs of A.W.P. and U.G.G. elevators.

STEP 2: Subtract interest on current operating funds category (which exists for U.G.G. only).

STEP 3: Recalculate and add a new interest on current operating funds category to variable costs from STEP 2 for A.W.P. and U.G.G. (see p. 55 for calculation). Call this ADJUSTED VARIABLE COSTS.

STEP 4: Take fixed costs of A.W.P. and U.G.G.

STEP 5: Subtract depreciation, interest on capital investment and administration and overhead categories from U.G.G. (interest on capital investment and administration and overhead categories exist for U.G.G. only). Subtract depreciation category from A.W.P.

STEP 6: Recalculate and add a new interest on capital investment and depreciation category to fixed costs from STEP 5 for A.W.P. and U.G.G. (see p. 58 for calculation). Call this ADJUSTED FIXED COSTS.

STEP 7: Add ADJUSTED VARIABLE COSTS (STEP 3) and ADJUSTED FIXED COSTS (STEP 6) to get ADJUSTED TOTAL COSTS for A.W.P. and U.G.G.

The cost data were collected and handled under two major divisions or categories: variable expenses and fixed expenses. Variable expenses were defined as expenses which varied with grain receipts, while fixed costs were defined as those costs which did not vary as grain receipts varied.

Studying the two accounting stances of the companies and discussing various costs with company accountants revealed that the terms fixed and variable costs were not used. For Alberta Wheat Pool the term controllable was used to mean variable expenses and non-controllable was used to mean fixed expenses. With United Grain Growers the term direct operating expenses was used to designate variable expenses and direct fixed expenses was deemed fixed costs at primary elevators. Closer examination of the individual expense items within each category showed that the two accounting systems were approximately the same.

The following table (Table V-2) shows the breakdown of cost items into variable and fixed components. In addition the table shows the percentage of total costs which are allocated to the cost of handling and storing grain. Since elevators handle farm supplies (fertilizer, herbicides) not all costs accounted for at an elevator can be attributed to grain. For example, with respect to salaries 85% of the managers' and workers' time was spent on handling grain and only 15% was spent on farm supplies or agro sales. The pro-ration figures on the various costs were obtained from the planning and management departments of the respective

TABLE V-2

BREAKDOWN OF COSTS INTO VARIABLE AND FIXED COMPONENTS WITH % OF TOTALS ALLOCATED TO GRAIN

	U.G.G.	A.W.P.
VARIABLE COSTS		
Salaries (including assistant managers, casual help, overtime, bonuses and benefits)	85	85
Moving,travel,meetings	75	85
Repairs	95	95
Annex unloading	100	100
Insurance	80	80
Heat, power and water	84	84
Postage, stationery and supplies	65	65
Phone, wire, telex	70	40
Interest on current operating funds	85	*
Miscellaneous (including scale inspection, uniforms, car liners, coopering and small tools)	85	85
FIXED COSTS		
Property rentals	56	56
Building insurance	80	80
Taxes	80	80
Interest on capital investment	80	*
Depreciation	80	80
Administration and overhead	80	*

* No allocation to primary elevators is made; all expenses are charged to head office.

grain companies.[1]

As shown in Table V-2 there is a difference in the way that the two companies handle interest on current operating funds (interest on working capital), interest on capital investment and administration and overhead. The Alberta Wheat Pool charges all interest expenses and administration and overhead expenses to the head office account. No allocation of these expenses back to their elevators is usually carried out. On the other hand United Grain Growers does allocate all administration and overhead expenses back to each individual elevator operating unit. Neither system of allocation is incorrect but does make cost comparisons between the two companies more difficult.

To equate the costs between Alberta Wheat Pool and United Grain Growers the following changes were made. Interest on current operating funds was recalculated at a rate of 10% per annum based on one-quarter of the prorated variable expense items. The figure arrived at represents the cost to the elevator for using capital to meet current cash expenses. A base of one-quarter of variable expenses was used in order to approximate the operating credit needs of the elevator through a one year time period.

Administration and overhead was handled in the manner that Alberta Wheat Pool handled this expense. This decision was made for two reasons. First, because the Alberta Wheat

----

[1]For a recent discussion on elevator costing see, U.S.D.A., Cost of Storing and Handling Grain and Controlling Dust in Commerical Elevators, 1971-72...Projections for 1973-74, Economic Research Service-513, Washington: U.S.D.A., 1973.

Pool made no allocation to elevators the construction of accounts and then choosing an arbirary allocation which should represent the amount charged to grain elevators would be required. The second reason for the decision is that many of the costs included with the administration and overhead account are not specifically related to the handling of grain (such as annual convention costs).

The expense item, interest on capital investment, was handled in conjunction with depreciation. Since depreciation is a book figure used for income tax purposes and owing to the wide range in age of the various elevators some elevators are fully depreciated and other, new elevators, are on the books at relatively high values. These figures are not very useful as some investments (elevators) are carried at very low values and the depreciation rates used may not always depict their productive values.

In order to normalize depreciation factors several alternatives were considered:

1. Multiply the current cost per tonne of building an elevator by the existing capacity for each elevator to obtain a current replacement value which would approximate current industry investment needs; and,
2. Use the insurance value associated with each elevator which represents an estimated value of the buildings and equipment for a particular site.

Method one is a valuation of a new building facility with current technology, while method two represents an estimated

current value of existing facilities.

Using insurance values to represent depreciation expenses was rejected for the following reason. United Grain Growers essentially based the insurance value of an elevator on its current replacement cost, making the two figures virtually identical. However, Alberta Wheat Pool had some elevators that were insured for slightly under current replacement cost and others which were insured for values as low as one dollar.[1] Examination of company construction costs and current elevator replacement estimates revealed that Alberta Wheat Pool's and United Grain Grower's figures were approximately the same. For this reason method one was chosen in calculating depreciation.

The cost per tonne figure calculated upon which depreciation rates could be based was $160 (1978 dollars). Therefore, to construct a single composite elevator (3,640 tonnes) in the 1978/79 would cost approximately 582,400 dollars. Based on methods used by the Alberta Wheat Pool's Planning and Management Department, depreciation was calculated using straight line over 40 years[2] with a zero salvage value at the end of its sevice life. The straight line method of depreciation was used because a constant depreciation rate for grain elevators is not an unreasonable assumption considering the relatively slow rate of

----

[1]Since the mid-1970's elevator construction costs have been escalating at approximately 11% while insurance values have been revised upward at a rate of 4%.

[2]Forty years represents the figure used to depreciate wooden structures while fifty years is used for concrete structures.

obsolescence in the elevator industry and because of its simplicity.

From the preceding discussion on depreciation and interest on capital investment the two costs were combined and calculated as follows:

$$\left[\$160 \times \text{Elevator Capacity} - \frac{0}{(1.12)^{40}}\right]\left[\frac{.12}{1-\left(\frac{1}{1.12}\right)^{40}}\right]$$

The first bracketed item represents the depreciation figure, with the zero representing the salvage value of the elevator after forty years. The second bracketed item represents the capital recovery factor[1] over forty years and at a nominal interest rate of 12%. The capital recovery factor represents the opportunity cost to the enterprise for using funds to build an elevator instead of investing the capital elsewhere. A 3,640 tonne elevator would be allocated an annual depreciation and interest on capital investment figure of $70,645,12.

Cost analysis was undertaken with two types of average cost figures. The first average cost (AC-1) is adjusted total costs divided by receipts of grain in tonnes. The second average cost (AC-2) is adjusted total costs less depreciation and interest on capital investment, divided by receipts of grain in tonnes. AC-2 was calculated in order to

----

[1]The capital recovery factor at 12% over 40 years is .1213.

evaluate the operational economics of scale that may be present within the primary elevator industry.

<u>Elevator Receipts of Grain</u> - Elevator receipts of grain were made available at the head offices of the two grain companies. The information was stored on and obtained from the year-end grain tapes at the Alberta Wheat Pool and from the year-end grain files at United Grain Growers. The main items categorized on these records were as follows:

1. Station Number;
2. Grain Code;
3. Grade Code and Grade Description;
4. Purchases;
5. Shipments;
6. Farm Storage;
7. Dockage; and,
8. Accounts used for cut-offs (weigh-overs).

The volume of receipts (tonnes) for each grade of grain that an elevator handled was defined as; purchases (including dockage) plus farm storage (for which graded storage tickets were issued) outstanding at year end (including dockage). This sum was felt to best represent the way in which a manager bins his grain and subsequently affects his availablle working space and receipts at an elevator.

Adding purchases and farm storage to shipments and in transit and then dividing by two was first hypothesized to give the best estimate of what an elevator handled.

Shipments represent the quantity of each grade of grain received and graded at the terminal elevator, and in transit represents the quantity of each grade of grain sent from a primary elevator yet not received at a terminal elevator. This method described was not used because the type of grain received at the terminal may differ from that binned and subsequently shipped by the primary elevator manager. For example, the primary elevator manager may grade, bin and ship 1 C.W.R.S. wheat but when it arrives at the terminal and is officially graded it may be declared 3 C.W.R.S. wheat. This method does not adequately represent the actual number of grades handled at the primary elevator level. On the other hand one could argue this is a cost of imperfect grading by managers and therefore a cost that should be included.

Board grades and off-Board grades that were identical were added together and represented by one grade. The two types are handled and stored together at the primary elevator but are recorded separately for accounting purposes. 17,213 grade observations existed over the four year period before Board and off-Board grades were combined. After the two groups were combined the total number of grade observations was reduced to 13,635, a decrease of 3,578 grade observations. Special bin storage tickets were not accounted for because of the difficulty in determining the time frame of the ticket issued. In most cases this account was transferred to purchases before the end of the crop

year.

B. Factors Effecting the Operations of Primary Elevators

Considerable time and effort was spent on a technique which would accurately measure the effect the numbers of grains and grades received may impose on the cost and handling volumes of primary elevators. To measure this function a grain index and a grade index were formulated within a regression model and were based on the proportion of receipts a grain or grade contributed to the total annual receipts at an elevator. The index was similar to the Gini-Coefficient and Lorenz curve used in the measurement of market concentrations.[1] However, working with the model revealed that the index was highly skewed to one side, it had a very restricted measurement range of less than one and that two different grain or grade combinations could obtain the same index number. For example, one elevator may handle 20 different grades of grain in a year with 3 grades comprising 80% of the total receipts. If an index was used which combined grade frequency based on receipts as a proportion of total receipts the index may be 22.0. In comparison, another elevator may handle only 17 different grades of grain but in different proportions than the first elevator and still come up with an index of 22.0. This hypothetical example shows one can actually be measuring two

----

[1] James V. Koch, Industrial Organization and Prices, Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1974, p. 150.

different factors simultaneously under this method. Further research of this method, and alternative methods, are recommended which may lead to an improved way of measuring the impact of handling varying numbers of grades by primary elevators. Consequently grain and grade effects were represented by the absolute number of grains or grades an elevator would receive in a crop year. For example, an elevator may receive four different grains and seventeen different grades in a particular crop year.

Models used in this Study - Model AC-1 was used for testing the impact of capacity, handling ratio (receipts over capacity) and the number of grains, grades and receipts.

$$AC\text{-}1 = a_1 + b_1 Cap + c_1 R + d_1 R/Cap + e_1 Gn + f_1 Gd + g_1 Dummy + U$$

where AC-1 = total average cost per tonne

Cap = elevator capacity

R = elevator receipts (tonnes)

R/Cap = elevator handling ratio

Gn = absolute grain frequency

Gd = absolute grade frequency

Dummy = a dummy variable to capture any age effect between elevators (24 years and less = 1, 25 years and older = 0)

U = error term

$a_1, b_1, c_1, d_1, e_1, f_1$, and g_1 are coefficients estimated.

Model AC-2 was used for testing the economics of scale

[illegible]

present within the primary elevator system. The independent variables are the same as those employed in Model AC-1; however, the dependent variable is changed and does not include the cost category of depreciation and interest on capital investment. The reason for leaving these costs out of the analysis was in order to study the characteristics of the elevator industry in association with primary elevator cash expenses.

$$AC\text{-}2 = a_2 + b_2Cap + c_2R + d_2R/Cap + e_2Gn + f_2Gd + g_2Dummy + U$$

where AC-2 = total average cost per tonne less depreciation and interest on capital investment

Cap = elevator capacity

R = elevator receipts

R/Cap = elevator handling ratio

Gn = absolute grain frequency

Gd = absolute grade frequency

Dummy = a dummy variable to capture any age effect between elevators (24 years and less = 1, 25 years and older = 0)

U = error term

$a_2, b_2, c_2, d_2, e_2, f_2$, and g_2 are coefficients estimated.

Capacity, receipts and handling ratio are interrelated; however, which variables were more important in explaining average costs were not known. Coefficients b , c and d were expected to be negative. Therefore, as capacity,

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

receipts and handling ratio increase then average cost should decrease within the relevant operating range. Coefficients e and f were expected to be positive because as the numbers of grains and grades received increased, average cost should be expected to increase. If coefficients e and f are positive and significant then one could conclude that the number of grains and grades received has an impact on average costs.

The dummy variable was included in order to determine whether or not any impact on average cost was due to the age of the elevator facility. Twenty-five years was chosen as the split between new and old elevators because these two time periods were felt to represent significant changes in current operating sizes and technologies within the primary elevator system.

Using total cost (not dividing by receipts) as opposed to average cost as the dependent variable and linear specification of the functional form were also analyzed. However, using average costs and a double log form provided the best results in terms of goodness of fit and significance of coefficients. Consequently only results using average costs under log forms have been presented. Since the independent variables were not able to explain variation in total cost as well as average cost, a high fixity of costs in the primary elevator industry may be the reason. However, more research would have had to be done before one could draw any conclusive results.

Results of the Regression under Model AC-1 - Model AC-1 consisted of six independent variables and average cost as the dependent variable. F values, which are the ratio of explained variance to the residual or unexplained variance, can be used to determine whether a variable is significant in explaining variation in the dependent variable. Increases in the F ratio mean that the numerator or explained variance is being added to the value. If the F ratio decreases with the addition of a variable then it has added more unexplained variance than explanatory variance.

Five of the six variables had significant coefficients in the regression as shown in the results of Table V-3. Receipts of grain, the sixth variable entered in the stepwise regression gave insufficient levels for computation. The correlation coefficient between volume of receipts and handling to capacity ratio was .71. R^2 was .938, the standard error (which measures the error of prediction) was .0422 and the F value was 1916.3517 for the equation. The five variables entered explain 93.8% of the variation in average cost. The receipts to capacity ratio was found to be the most important variable in explaining average costs incurred by elevators.

The first five variables were all significant at the .01 level, meaning that in only 1 case in 100 will the model not explain the variation in average cost. If the coefficients are not significantly different from 0 then they can be excluded from the equation as they can not

TABLE V-3

F TESTS FOR COEFFICIENTS
OF DETERMINATION FOR MODEL AC-1

Variable	B Coefficient	R^2 Change	F(5,637)	F Table (.01)
Handling Ratio	-.8573 (.0096)*	.9286	7923.233	3.02
Capacity	-.1045 (.0128)	.0074	67.162	3.02
Age	+.0111 (.0042)	.0008	6.948	3.02
Grain Frequency	-.0473 (.0197)	.0004	5.745	3.02
Grade Frequency	+.0281 (.0132)	.0004	4.504	3.02
Receipts	N.S.	N.S.	N.S.	
(constant)	1.7441			

*Standard error in parentheses

explain any of the variation in the dependent variable.

Table V-4 shows the confidence limits at .05 and .10 for average costs between 1975/76 and 1978/79. The standard error and AC-1 figures are taken from the double log form regression so consequently the antilog of the numbers have been calculated and are shown.

As mentioned previously in this chapter the double log form regression yielded a higher goodness of fit and more significant coefficients in the equation than did the linear form. The double log form shows an average cost over the four year period of $10.19 per tonne (average for all elevators). This figure represents the geometric mean for elevator costs while the arithmetic mean obtained from the linear form showed a higher average of $11.04.

The following table (Table V-5) give the results from Model AC-2. The equation yielded a lower R^2 of .4255, a lower F value of 94.356 and a higher standard error of .12866 than Model AC-1.

The coefficient for grade frequency is again significant at .01. The F statistic at the .05 level of significance is 2.21. The sign of the grade frequency coefficient and the other four significant coefficients did not change between AC-1 and AC-2. The three negative coefficients imply that as handling ratio, capacity and grain frequency increase, average cost decreases. The two positive coefficients, age and grade frequency imply that as the age of the elevator and the number of grades received

TABLE V-4

CONFIDENCE LIMITS OF MODEL AC-1
AT SELECTED CRITICAL VALUES

Significance Level	z Value	Standard Error (antilog)	AC-1 (antilog)	Upper Limit	Lower Limit	Confidence Interval
.05	1.96	1.1020	10.19	12.35	8.03	4.32
.10	1.64	1.1020	10.19	12.00	8.38	3.62

TABLE V-5

F TESTS FOR COEFFICIENTS
OF DETERMINATION FOR MODEL AC-2

Variable	B Coefficient	R^2 Change	F(5,637)	F Table (.01)
Handling Ratio	-.5699 (.0294)*	.3532	375.929	3.02
Capacity	-.2914 (.0389)	.0594	56.297	3.02
Age	+.0319 (.0129)	.0074	6.121	3.02
Grain Frequency	-.1437 (.0602)	.0036	5.701	3.02
Grade Frequency	+.0725 (.0404)	.0029	3.230	3.02
Receipts	N.S.	N.S.	N.S.	
(constant)	1.7450			

*Standard error in parentheses

increases, average cost also increases.

The following results indicate the handling ratio is the single most important factor affecting average costs at elevators. Other factors which could explain variation in average cost yet not included in this research, such as management, will be discussed in the next chapter along with a discussion of the various hypotheses put forward.

Table V-6 gives the confidence limits at .05 and .10 for average costs between 1975/76 and 1978/79 under Model AC-2.

TABLE V-6

CONFIDENCE LIMITS OF MODEL AC-2
AT SELECTED CRITICAL VALUES

Significance Level	z Value	Standard Error (antilog)	AC-1 (antilog)	Upper Limit	Lower Limit	Confidence Interval
.05	1.96	1.345	3.04	5.68	.40	5.28
.10	1.64	1.345	3.04	5.25	.83	4.42

<u>Grain</u> <u>Frequencies</u> - In total, Alberta primary elevators handled ten different classes of grain in the sample taken over the four year time period. The ten different grains handled at primary elevators in order of most receipts were: wheat, barley, oats, rapeseed, rye, durum wheat, flaxseed, mustard, clover and mixed grain. The average number of grains received per year at a single elevator over the four year time period was 4.85, with a standard deviation of 0.96. Table V-7 shows the relationship that exists between grains handled and elevator capacity. Elevators with a

capacity of less than 2,000 tonnes handled an average of 4.34 grains while elevators over 5,000 tonnes in capacity handled an average of 5.58 grains.

An F test can be used for analysis of variance between groups (in this case different capacity categories) and within groups (within capacity categories). F is the ratio of the estimated variance in the population based on the variation between the sample means to the estimated variance in the population based on the variation within the samples. The computed F value is then compared to a particular critical value. In Table V-7 the F value for the four year means is 28.36 and is within the .01 critical range. Therefore one can conclude that grain frequencies between capacity categories are of significant difference at the .01 level. All F values for the tables presented can be interpreted in a similar manner.

In the following tables x is the arithmetic mean, s is the standard deviation and N is the number of elevators in the group.

Regional differences in the numbers of grains handled per year by primary elevators was also analyzed and the results are represented in Table V-8. Appendix L shows a map of the various regions used. The number of grains received by primary elevators based on region was found to be significant at the .05 level for only the period data. However, the mix of grains received did vary between regions. Relatively more wheat and flaxseed was found to be

TABLE V-7

AVERAGE GRAIN FREQUENCY
BY ELEVATOR CAPACITY

		75/76	76/77	77/78	78/79	Period
Lowest through 2000 tonnes capacity	x[1]	4.19	4.16	4.29	4.71	4.34
	s	(.54)	(.68)	(.90)	(1.16)	(.87)
	N	(31)	(32)	(31)	(31)	(125)
2001-3000	x	4.68	4.53	4.43	4.78	4.60
	s	(1.00)	(.93)	(.87)	(.92)	(.93)
	N	(37)	(40)	(40)	(40)	(157)
3001-4000	x	4.98	4.78	4.82	4.94	4.87
	s	(.93)	(.77)	(.99)	(1.07)	(.94)
	N	(46)	(49)	(49)	(47)	(191)
4001-5000	x	5.37	5.41	5.21	5.27	5.41
	s	(1.12)	(.96)	(.85)	(1.13)	(1.03)
	N	(31)	(34)	(34)	(33)	(132)
Over 5000 tonnes capacity	x	6.25	5.60	5.10	5.50	5.58
	s	(.89)	(1.35)	(1.37)	(.85)	(1.18)
	N	(8)	(10)	(10)	(10)	(38)
Total	x	4.97	4.78	4.72	4.96	4.85
	s	(.93)	(.88)	(.95)	(1.05)	(.96)
	N	(153)	(165)	(164)	(161)	(643)
F value		16.06	11.46	5.36	2.13	28.36
Significant at		.01	.01	.01	.08	.01

----

[1]In the following tables, x refers to the arithmetic mean, s refers to the standard deviation and N refers to the number of elevators in the group.

TABLE V-8

AVERAGE GRAIN FREQUENCY
BY ELEVATOR REGION

		75/76	76/77	77/78	78/79	Period
Region A	x	5.11	4.69	4.52	5.17	4.87
	s	(1.12)	(1.00)	(.99)	(1.00)	(1.04)
	N	(27)	(29)	(29)	(29)	(114)
Region B	x	5.24	4.98	4.89	4.98	5.02
	s	(1.22)	(1.15)	(1.17)	(1.18)	(1.18)
	N	(41)	(44)	(44)	(42)	(171)
Region C	x	4.91	4.67	4.62	4.92	4.78
	s	(1.04)	(.84)	(.85)	(1.09)	(.96)
	N	(35)	(39)	(39)	(39)	(152)
Region D	x	4.48	4.59	4.69	4.80	4.63
	s	(.80)	(.97)	(1.05)	(.87)	(.92)
	N	(27)	(27)	(26)	(25)	(105)
Region E	x	5.00	4.88	4.85	4.88	4.90
	s	(1.09)	(.86)	(.88)	(1.14)	(.89)
	N	(23)	(26)	(26)	(26)	(101)
Total	x	4.97	4.78	4.72	4.96	4.85
	s	(1.08)	(.98)	(1.00)	(1.08)	(1.03)
	N	(153)	(165)	(164)	(161)	(643)
F value		2.19	.95	.82	.47	2.49
Significant at		.07	.44	.51	.76	.05

delivered in the south while barley and rapeseed were the predominant grains received by primary elevators in the north (Region E).

<u>Grade Frequencies</u> - The average number of grades received per year at a primary elevator over the four year period was 17.50, with a standard deviation of 5.99 (Table V-9). Figure V-2 shows the grade frequency relationship to primary elevator capacity in the form of a histogram. All histograms presented in this chapter are period averages, meaning the results are grouped together for the four crop years 1975/76 to 1978/79. The histograms were constructed from the corresponding tables in the chapter.

The 1975/76 crop year had the highest average number of grades received by primary elevators with 19.46, while the 1976/77 crop year showed the lowest average at 14.76 grades per elevator. In terms of elevator capacity Table V-9 shows smaller primary elevators receiving relatively fewer grades per year than larger primary elevators. This relationship was significant at the .01 level.

Table V-10 shows the average number of grades handled by primary elevators and the grade fequency variation that exists due to regional differences. The variation between groups is significant at the .01 level. As shown in Table V-10 Region D (Northeastern) and Region E (Peace River) received above the average number of grades at primary elevators. The Peace River Region received an average of

TABLE V-9

AVERAGE GRADE FREQUENCY
BY ELEVATOR CAPACITY

		75/76	76/77	77/78	78/79	Period
Lowest through	x	14.23	11.31	14.61	12.87	13.23
2000 tones	s	(4.20)	(4.90)	(5.46)	(3.78)	(4.76)
capacity	N	(31)	(32)	(31)	(31)	(125)
	x	16.46	12.68	16.00	15.15	15.04
2001-3000	s	(4.49)	(3.92)	(4.63)	(4.61)	(4.62)
	N	(37)	(40)	(40)	(40)	(157)
	x	21.24	15.61	19.60	18.51	18.71
3001-4000	s	(5.83)	(5.93)	(7.05)	(5.63)	(6.43)
	N	(46)	(49)	(49)	(47)	(191)
	x	23.77	18.50	23.06	21.24	21.60
4001-5000	s	(6.61)	(5.56)	(8.09)	(6.56)	(7.00)
	N	(31)	(33)	(34)	(33)	(132)
Over	x	26.63	17.20	20.00	22.80	21.39
5000 tonnes	s	(8.09)	(5.75)	(8.62)	(8.18)	(8.15)
capacity	N	(8)	(10)	(10)	(10)	(38)
	x	19.46	14.76	18.52	17.41	17.50
Total	s	(5.55)	(5.22)	(6.61)	(5.48)	(5.99)
	N	(153)	(165)	(164)	(161)	(643)
F value		18.82	10.34	8.63	14.00	43.89
Significant at		.01	.01	.01	.01	.01

FIGURE V-2
AVERAGE GRADE FREQUENCY
BY ELEVATOR CAPACITY
(PERIOD)

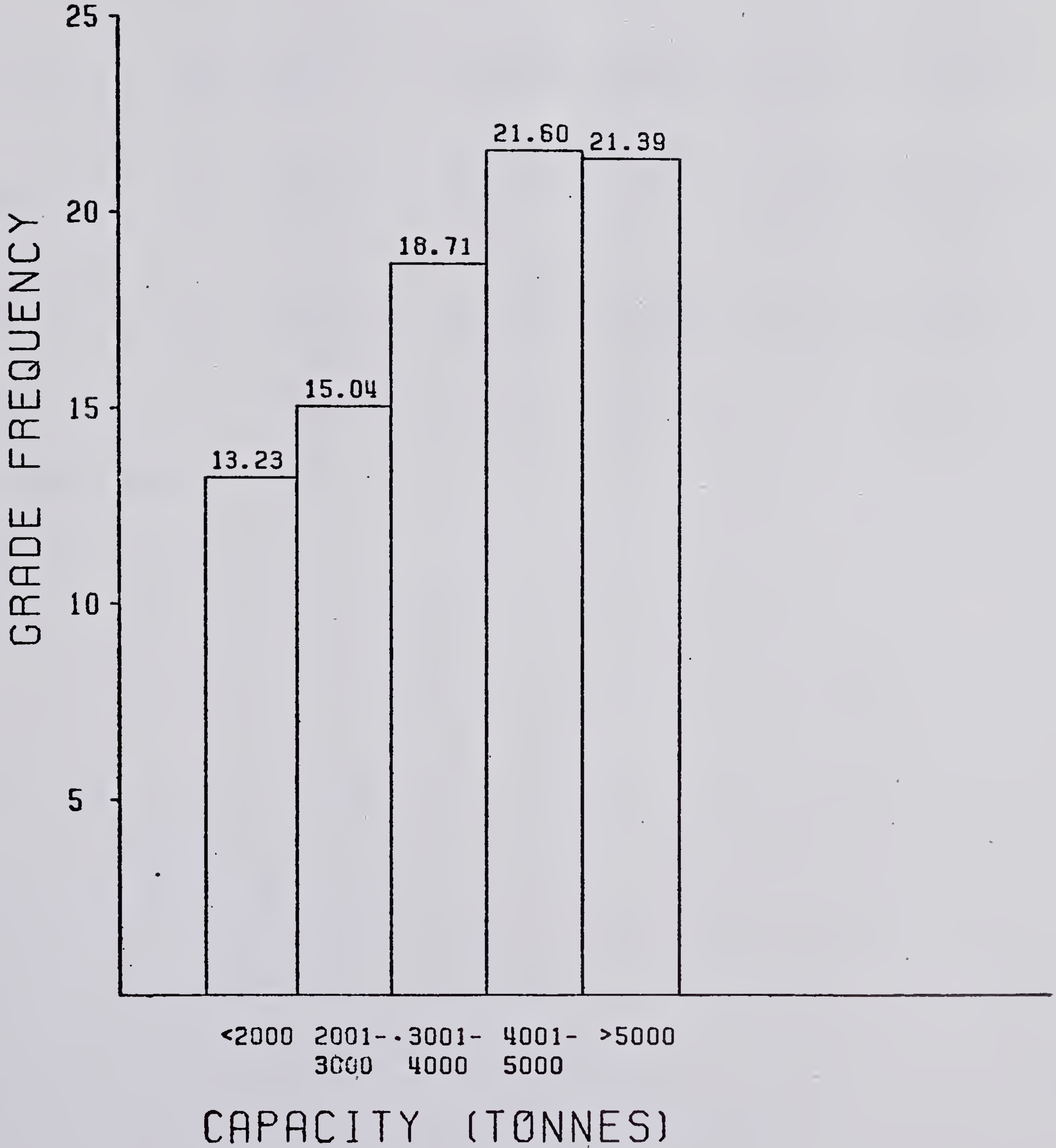


TABLE V-10

AVERAGE GRADE FREQUENCY
BY ELEVATOR REGION

		75/76	76/77	77/78	78/79	Period
Region A	x	20.36	15.55	16.14	18.31	17.52
	s	(7.35)	(5.57)	(5.79)	(6.19)	(6.43)
	N	(27)	(29)	(29)	(29)	(114)
Region B	x	17.80	12.77	15.86	16.95	15.80
	s	(5.87)	(4.41)	(5.63)	(6.15)	(5.82)
	N	(41)	(44)	(44)	(42)	(171)
Region C	x	16.26	12.74	16.46	15.15	15.13
	s	(4.47)	(4.38)	(5.51)	(5.23)	(5.11)
	N	(35)	(39)	(39)	(37)	(152)
Region D	x	19.59	14.26	19.73	17.00	17.64
	s	(6.17)	(4.64)	(5.36)	(5.81)	(5.89)
	N	(27)	(27)	(26)	(25)	(105)
Region E	x	26.17	20.77	27.58	20.92	23.79
	s	(6.38)	(6.90)	(7.66)	(7.34)	(7.65)
	N	(23)	(26)	(26)	(26)	(101)
Total	x	19.46	14.76	18.52	17.41	17.50
	s	(6.01)	(5.11)	(5.96)	(6.11)	(6.11)
	N	(153)	(165)	(164)	(161)	(643)
F value		10.57	12.40	19.81	3.73	35.83
Significant at		.01	.01	.01	.01	.01

23.79 grades per elevator while Region C (Central) received 15.13 grades per elevator. Soil and weather variations relative to northern and southern Regions of Alberta can probably be attributed for most of the grade variance between regions that is occurring. Figure V-3 depicts the period results from Table V-10 in the form of a histogram.

Table V-11 shows the total number of different grades and grains received by primary elevators for each of the four years.

TABLE V-11

TOTAL NUMBER OF DIFFERENT GRAINS AND GRADES RECEIVED BY PRIMARY ELEVATORS

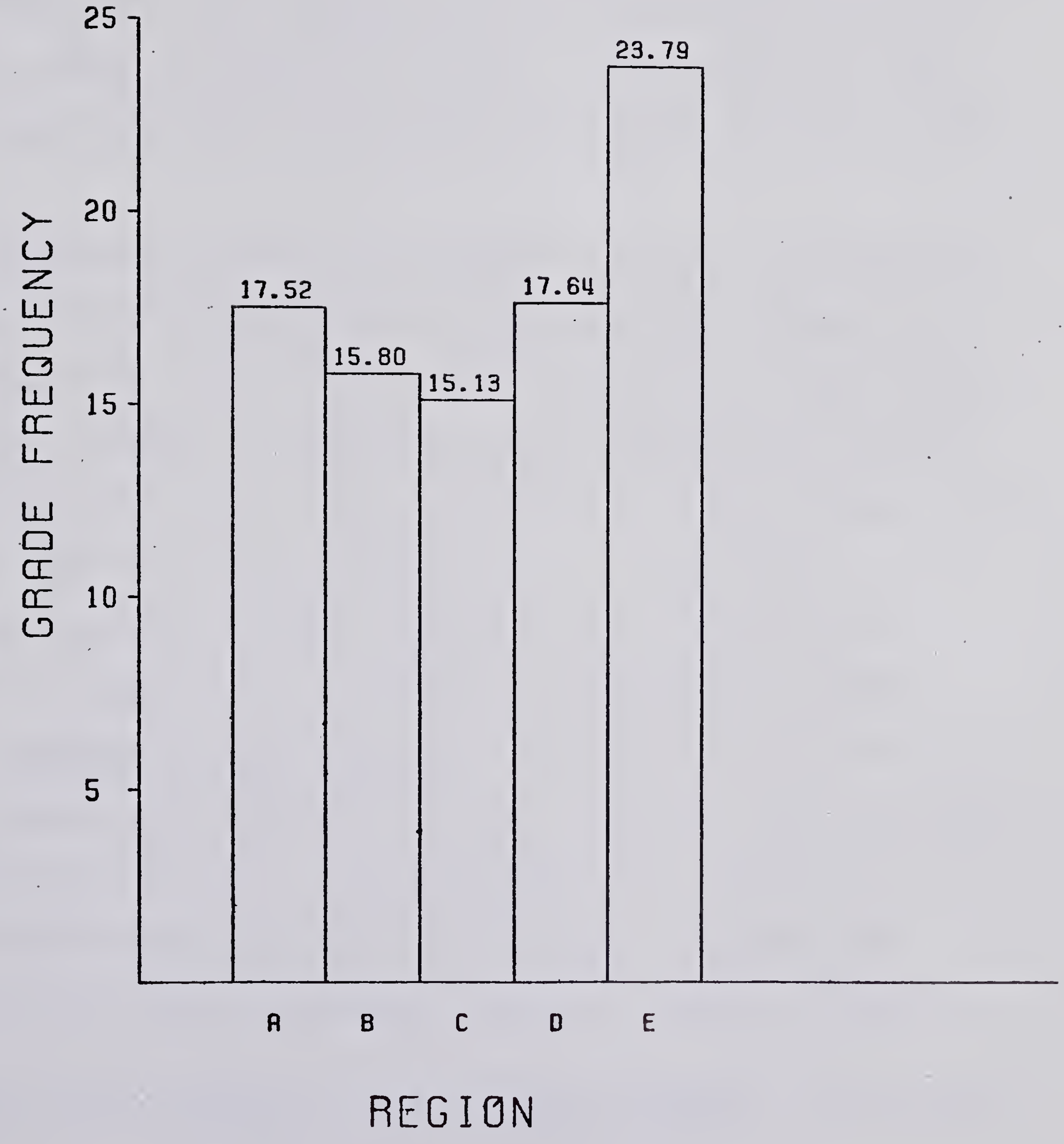
	1975/76	1976/77	1977/78	1978/79	Period
Grains	10	10	9	9	10
Grades	141	123	127	136	198

The deleted grain for 1977/78 and 1978/79 crop years was the class mixed grain. Elevator policy attempted to discourage delivery of mixed grain through primary elevators starting in 1977/78 and suggested delivery instead to feedlots; thus reducing elevator congestion at the primary elevator.

One should note with respect to the total number of grades that many occur fewer than ten times in a crop year and that many of these only once or twice. The effects of small amounts of grade classes on the entire grain handling and transportation system is exemplified by the fact that only one car load of 1 C.W. 6 Row barley and one car load of

FIGURE V-3

AVERAGE GRADE FREQUENCY
BY ELEVATOR REGION
(PERIOD)



4 C.W. flaxseed was inspected at Vancouver in the 1978/79 crop year.[1] The operational problems that occur at the port terminal level from such few numbers of grades will be dealt with in the last chapter.

Elevator Receipts - The average primary elevator receipts was 9,602 tonnes of grain per year based on the four year average, with the larger elevators receiving more grain than the smaller capacity elevators (Table V-12). Elevators with a capacity of less than 2000 tonnes received an average of 5,684 tonnes per year while elevators over 5,000 tonnes in capacity averaged 16,805 tonnes per year. Receipts stratified by capacity was significant at the .01 level.

Table V-13 reveals that Region A (South) and Region E (Peace River) obtained the highest four year average annual receipts with 10,560 tonnes and 12,467 tonnes respectively. Region C (Central) showed the lowest receipts per elevator based on a four year annual average with 8,399 tonnes. The F values for 1977/78 and 1978/79 are not significant, indicating that in those two years more variation in receipts occurred within regions than between regions.

Elevator Age and Capacity - As stated previously there is a large cross-section of primary elevator sizes and ages in the grain handling and transportation system in Alberta. Considering age variation first, Figure V-4 gives the average year that an elevator was built based on elevator

----

[1]Canada Grains Council, Canada Grains Industry, Statistical Handbook 79, Winnipeg: C.G.C., 1979, p. 203.

TABLE V-12

AVERAGE GRAIN RECEIPTS
BY ELEVATOR CAPACITY
(tonnes)

		75/76	76/77	77/78	78/79	Period
Lowest through 2000 tonnes capacity	x	5266	6126	5719	5609	5684
	s	(2362)	(3077)	(3283)	(3869)	(3169)
	N	(31)	(32)	(31)	(31)	(125)
2001-3000	x	6601	7396	7306	6222	6887
	s	(2397)	(2794)	(2982)	(2995)	(2826)
	N	(37)	(40)	(40)	(40)	(157)
3001-4000	x	10003	11278	9845	9912	10267
	s	(4065)	(4952)	(3597)	(4740)	(4379)
	N	(46)	(49)	(49)	(47)	(191)
4001-5000	x	12636	14084	13195	14039	13504
	s	(4373)	(5275)	(5773)	(6066)	(5397)
	N	(31)	(34)	(34)	(33)	(132)
Over 5000 tonnes capacity	x	17621	16074	16000	17689	16805
	s	(5076)	(6013)	(6650)	(6550)	(5961)
	N	(8)	(10)	(10)	(10)	(38)
Total	x	9152	10207	9516	9496	9602
	s	(3556)	(4344)	(4188)	(4666)	(4202)
	N	(153)	(165)	(164)	(161)	(643)
F value		33.45	23.33	21.79	25.93	101.12
Significant at		.01	.01	.01	.08	.01

TABLE V-13

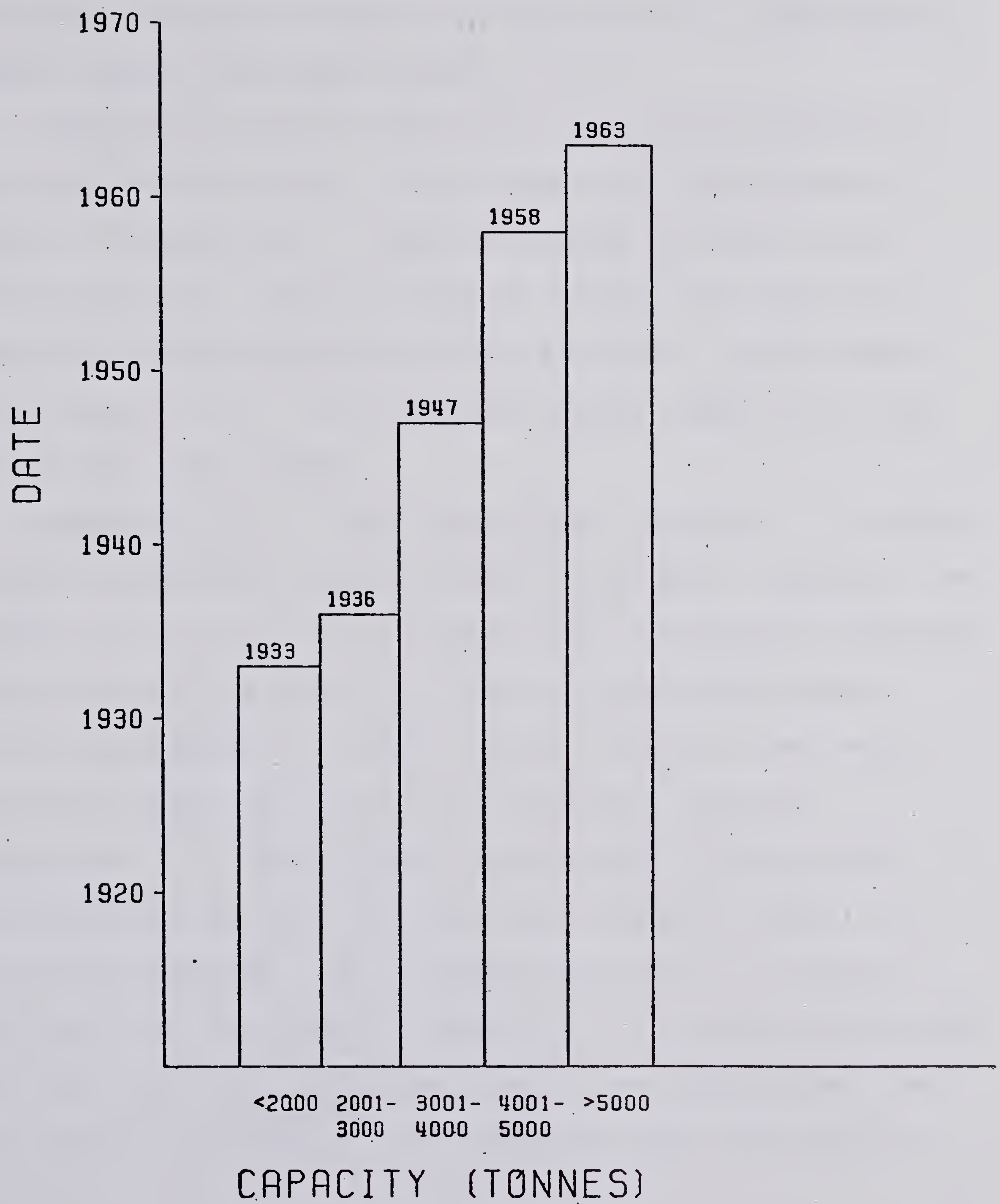
AVERAGE GRAIN RECEIPTS
BY ELEVATOR REGION
(tonnes)

		75/76	76/77	77/78	78/79	Period
Region A	x	10588	11186	9886	10582	10560
	s	(5384)	(5927)	(5315)	(6709)	(5809)
	N	(27)	(29)	(29)	(219	(114)
Region B	x	8833	8402	8468	8542	8569
	s	(5177)	(5051)	(6175)	(6336)	(5667)
	N	(41)	(44)	(44)	(42)	(171)
Region C	x	7347	8702	9029	8412	8399
	s	(3441)	(3333)	(3919)	(4059)	(3722)
	N	(35)	(39)	(39)	(39)	(152)
Region D	x	7558	9497	10180	9765	9226
	s	(3414)	(4537)	(5068)	(6226)	(4921)
	N	(27)	(27)	(26)	(25)	(105)
Region E	x	12566	15183	10941	11191	12467
	s	(4878)	(5740)	(4625)	(6312)	(5633)
	N	(23)	(26)	(26)	(26)	(101)
Total	x	9152	10207	9516	9496	9602
	s	(4543)	(4913)	(5134)	(5915)	(5171)
	N	(153)	(165)	(164)	(161)	(643)
F value		6.17	9.50	1.19	1.39	12.64
Significant at		.01	.01	.32	.24	.01

[illegible]

FIGURE V-4

AVERAGE ELEVATOR CONSTRUCTION
DATE BY ELEVATOR CAPACITY



capacity. As one would expect the larger elevators are also the newer elevators. Primary elevators over 5,000 tonnes in capacity were constructed approximately 16 years ago (1963) while elevators under 2,000 tonnes in capacity average approximately 46 years of age (1933). The average elevator age is 34 years old, giving it a construction date of 1945. The oldest elevator in the sample was built in 1903 and the newest elevator was constructed in 1974.

Analyzing elevator capacities and construction dates revealed that the newer, larger elevators are situated in Region E (Peace River). Figure V-5 shows that four year average elevator capacity based on region and Figure V-6 shows the average construction date based on region (both significant at .01). The average elevator capacity of the sample was 3,197 tonnes.

Handling Ratio - Handling ratio or turnover is a common elevator performance measure used in the grain industry. The figure is arrived at by dividing annual receipts by elevator capacity and shows how many times an elevator has been filled and emptied in a year. Table V-14 gives then yearly averages and period average for different elevator capacities. A .01 statistical significant difference was found between the handling ratio and elevator capacity for the period averages. The handling ratio for all elevators from the four year time period was 3.07. In other words over the last four years elevators have filled and emptied their facilities an average of 3.07 times per year. One should

FIGURE V-5

AVERAGE ELEVATOR CAPACITY
BY REGION

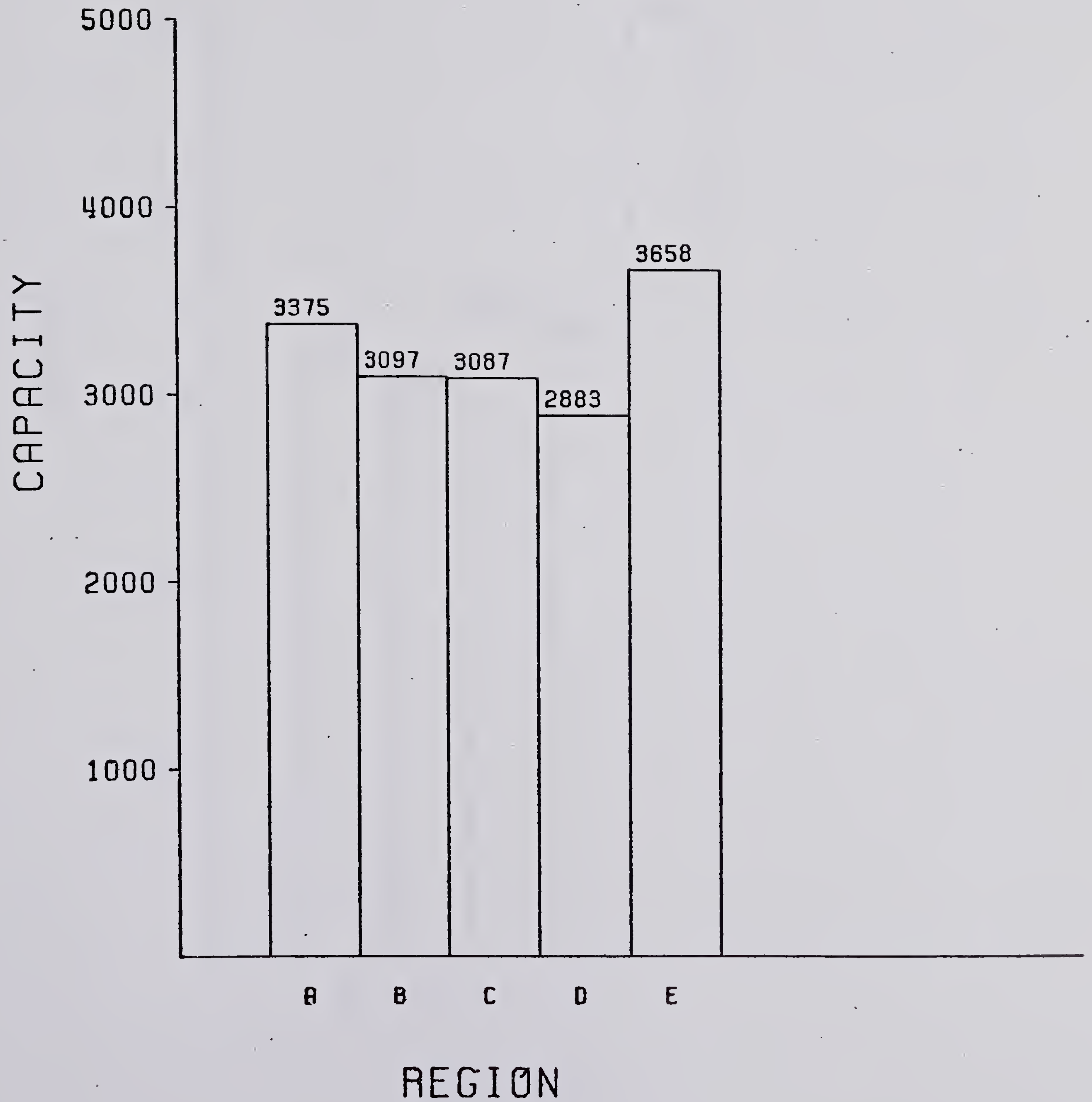


FIGURE V-6

AVERAGE CONSTRUCTION DATE
OF ELEVATORS BY REGION

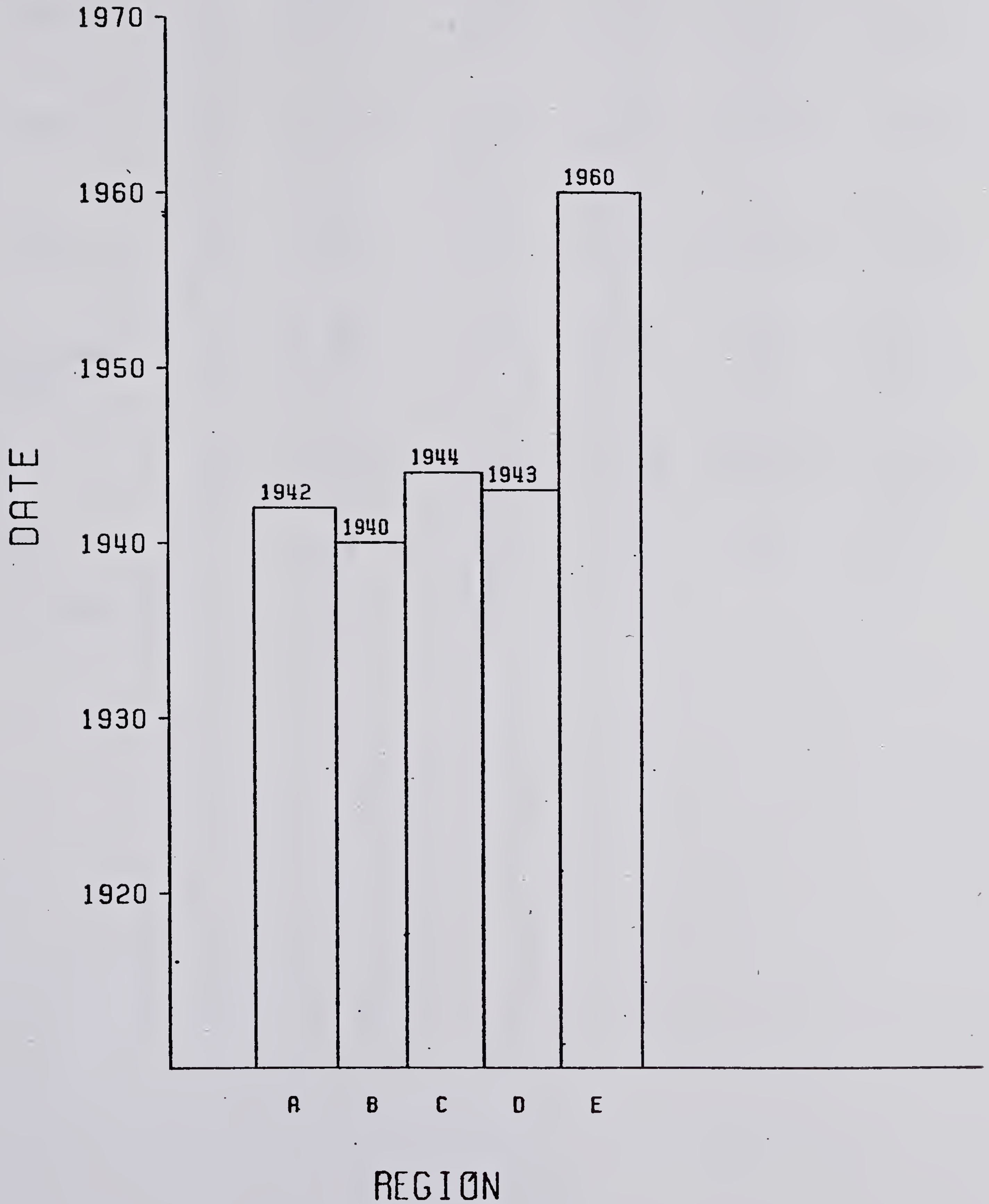


TABLE V-14

AVERAGE HANDLING RATIO
BY ELEVATOR CAPACITY

		75/76	76/77	77/78	78/79	Period
Lowest through	x	3.42	3.94	3.65	3.65	3.67
2000 tones	s	(1.83)	(2.42)	(2.56)	(3.14)	(2.50)
capacity	N	(31)	(32)	(31)	(31)	(125)
	x	2.68	2.98	2.94	2.49	2.77
2001-3000	s	(1.04)	(1.14)	(1.22)	(1.21)	(1.16)
	N	(37)	(40)	(40)	(40)	(157)
	x	2.95	3.29	2.89	2.89	3.01
3001-4000	s	(1.15)	(1.31)	(1.01)	(1.28)	(1.20)
	N	(46)	(49)	(49)	(47)	(191)
	x	2.80	3.13	2.92	3.12	3.00
4001-5000	s	(.90)	(1.11)	(1.19)	(1.28)	(1.13)
	N	(31)	(34)	(34)	(33)	(132)
Over	x	3.02	2.72	2.71	3.00	2.85
5000 tonnes	s	(.62)	(.84)	(.96)	(.90)	(.83)
capacity	N	(8)	(10)	(10)	(10)	(38)
	x	2.95	3.27	3.04	2.99	3.07
Total	s	(1.24)	(1.50)	(i.50)	(1.77)	(1.51)
	N	(153)	(165)	(164)	(161)	(643)
F value		1.69	2.36	1.62	1.94	6.74
Significant at		.16	.06	.17	.11	.01

note the consistently high handling ratios for the smaller capacity elevators.

Handling ratios statified by elevator region are shown in Table V-15. Region B and C showed the lowest four year average handling ratios of the five regions. The two regions also had the lowest four year average receipts per elevator which would in turn lower these regions turnover ratios.

Elevator Costs - As shown in the stepwise regression equations the handling ratio (receipts over capacity) was the most important variable in explaining variation in average costs. Other factors shown to explain variation in average costs but not to the extent of handling ratio were, capacity, age, number of grains received and number of grades received. Volume of grain receipts was the only variable which showed a strong degree of multicollinearity (.71) with handling ratio. Handling ratio will be the first variable considered in more detail with respect to the two different types of average costs used. Other factors considered in this section in conjuction with average costs are elevator capacity, receipts and location. When referring to these costs one must keep in mind the point that all costs are current year dollar figures except construction costs, which are constant dollar figures ($160 per tonne).

Table V-16 provides a yearly and period average cost breakdown for elevators with handling ratios ranging from below 1 to more than 6. Table V-16 uses average costs as employed in Model AC-1 while Table V-17 is similar except

[illegible]

TABLE V-15

AVERAGE HANDLING RATIO
BY ELEVATOR REGION

		75/76	76/77	77/78	78/79	Period
Region A	x	3.39	3.43	3.07	3.19	3.27
	s	(1.37)	(1.44)	(1.68)	(1.59)	(1.51)
	N	(27)	(29)	(29)	(219	(114)
Region B	x	2.95	2.74	2.69	2.68	2.76
	s	(.95)	(1.04)	(1.18)	(1.50)	(1.18)
	N	(41)	(44)	(44)	(42)	(171)
Region C	x	2.45	2.86	2.94	2.74	2.75
	s	(.93)	(.87)	(1.02)	(1.18)	(1.01)
	N	(35)	(39)	(39)	(39)	(152)
Region D	x	2.83	3.58	3.72	3.58	3.42
	s	(1.68)	(2.40)	(2.38)	(3.06)	(2.20)
	N	(27)	(27)	(26)	(25)	(105)
Region E	x	3.35	4.29	3.10	3.07	3.45
	s	(1.18)	(1.44)	(1.18)	(1.48)	(1.41)
	N	(23)	(26)	(26)	(26)	(101)
Total	x	2.95	3.27	3.04	2.99	3.07
	s	(1.21)	(1.45)	(1.49)	(1.78)	(1.51)
	N	(53)	(165)	(164)	(161)	(643)
F value		3.04	5.88	2.03	1.30	7.02
Significant at		.02	.01	.09	.27	.01

TABLE V-16

AVERAGE COST PER TONNE
BY ELEVATOR HANDLING RATIO
($ per tonne)

		75/76	76/77	77/78	78/79	Period
Less than 1	x	26.44	28.50	37.22	30.38	32.74
	s	(0)	(0)	(18.40)	(3.78)	(12.05)
	N	(1)	(1)	(5)	(5)	(12)
1 - 1.999	x	16.37	18.16	16.39	18.62	17.33
	s	(3.22)	(3.72)	(2.35)	(3.63)	(3.36)
	N	(30)	(16)	(29)	(33)	(108)
2 - 2.999	x	10.41	11.05	11.21	11.88	11.15
	s	(1.19)	(1.22)	(1.45)	(1.68)	(1.48)
	N	(57)	(71)	(61)	(62)	(251)
3 - 3.999	x	7.75	8.42	8.39	9.00	8.37
	s	(.73)	(1.11)	(.91)	(1.07)	(1.05)
	N	(41)	(35)	(43)	(37)	(156)
4 - 4.999	x	6.29	6.84	6.96	7.85	6.93
	s	(.70)	(.68)	(.74)	(.95)	(.89)
	N	(15)	(25)	(15)	(12)	(67)
5 - 5.999	x	5.05	5.80	6.28	6.69	5.92
	s	(.38)	(.42)	(.62)	(.61)	(.76)
	N	(7)	(9)	(7)	(6)	(29)
More than 6	x	3.69	4.67	4.67	5.21	4.74
	s	(.33)	(.33)	(.94)	(.86)	(.75)
	N	(2)	(81)	(4)	(6)	(20)
Total	x	10.23	10.06	11.42	12.43	11.04
	s	(1.67)	(1.52)	(3.27)	(2.15)	(2.38)
	N	(153)	(165)	(164)	(161)	(643)
F value		128.30	158.71	79.42	148.00	404.52
Significant at		.01	.01	.01	.01	.01

[illegible]

TABLE V-17

AVERAGE COST PER TONNE LESS DEPRECIATION AND INTEREST ON INVESTMENT BY ELEVATOR HANDLING RATIO
($ per tonne)

		75/76	76/77	77/78	78/79	Period
Less than 1	x	5.07	4.59	8.43	7.01	7.24
	s	(0)	(0)	(2.42)	(1.87)	(2.27)
	N	(1)	(1)	(5)	(5)	(12)
1 - 1.999	x	3.58	4.29	4.43	5.42	4.48
	s	(1.12	(.75)	(.93)	(1.67)	(1.41)
	N	(30)	(16)	(29)	(33)	(108)
2 - 2.999	x	2.59	3.24	3.52	3.99	3.35
	s	(.56)	(.73)	(1.05)	(1.13)	(1.02)
	N	(57)	(71)	(61)	(62)	(251)
3 - 3.999	x	2.01	2.71	2.82	3.42	2.72
	s	(.49)	(.82)	(.66)	(1.00)	(.90)
	N	(41)	(35)	(43)	(37)	(156)
4 - 4.999	x	1.84	2.38	2.59	3.50	2.51
	s	(.62)	(.53)	(.58)	(.85)	(.82)
	N	(15)	(25)	(15)	(12)	(67)
5 - 5.999	x	1.34	2.11	2.66	3.02	2.25
	s	(.27)	(.31)	(.57)	(.52)	(.74)
	N	(7)	(9)	(7)	(6)	(29)
More than 6	x	1.45	1.88	2.31	2.94	2.24
	s	(.21)	(.41)	(.41)	(.35)	(.63)
	N	(2)	(8)	(4)	(6)	(20)
Total	x	2.50	2.98	3.50	4.14	3.29
	s	(.69)	(.70)	(.94)	(1.21)	(1.07)
	N	(153)	(165)	(164)	(161)	(643)
F value		24.73	21.27	35.53	15.46	71.13
Significant at		.01	.01	.01	.01	.01

the cost averages tabulated do not include depreciation and interest on capital investment. Figures V-7 and V-8 follow and are graphical representations of the two previous tables.

The two figures visualize the extent to which average costs decrease with an increase in handling ratio. At handling ratios of six and over average cost is still seen as declining. This implies that elevators are still moving down the average cost curve. This elevator sample did not include elevators with extremely high handling ratios to conclude at what point average cost would begin to rise and economies of scale have been met for the primary elevator industry as a whole. Squaring the handling ratio variable may be one possible alternative which would have allowed any diseconomies to be reflected in the results.

Table V-16 and V-17 contain coefficients which are significant at the .01 level; that is, there is more variation in average costs between various handling ratio groups than within various handling ratio groups.

Average costs (AC-1) stratified by elevator capacity for each year and for a period average are shown in Table V-18. No strong statistical significance (.37) was found to support the position that larger elevators are more cost efficient to operate than smaller elevators on an average cost basis. Elevators with capacities less than 2,000 tonnes had an average period cost of $10.81 and elevators with 5,000 tonnes had an average period cost of $10.48. The

FIGURE V-7

AVERAGE COST PER TONNE
BY ELEVATOR HANDLING RATIO
($ per tonne)

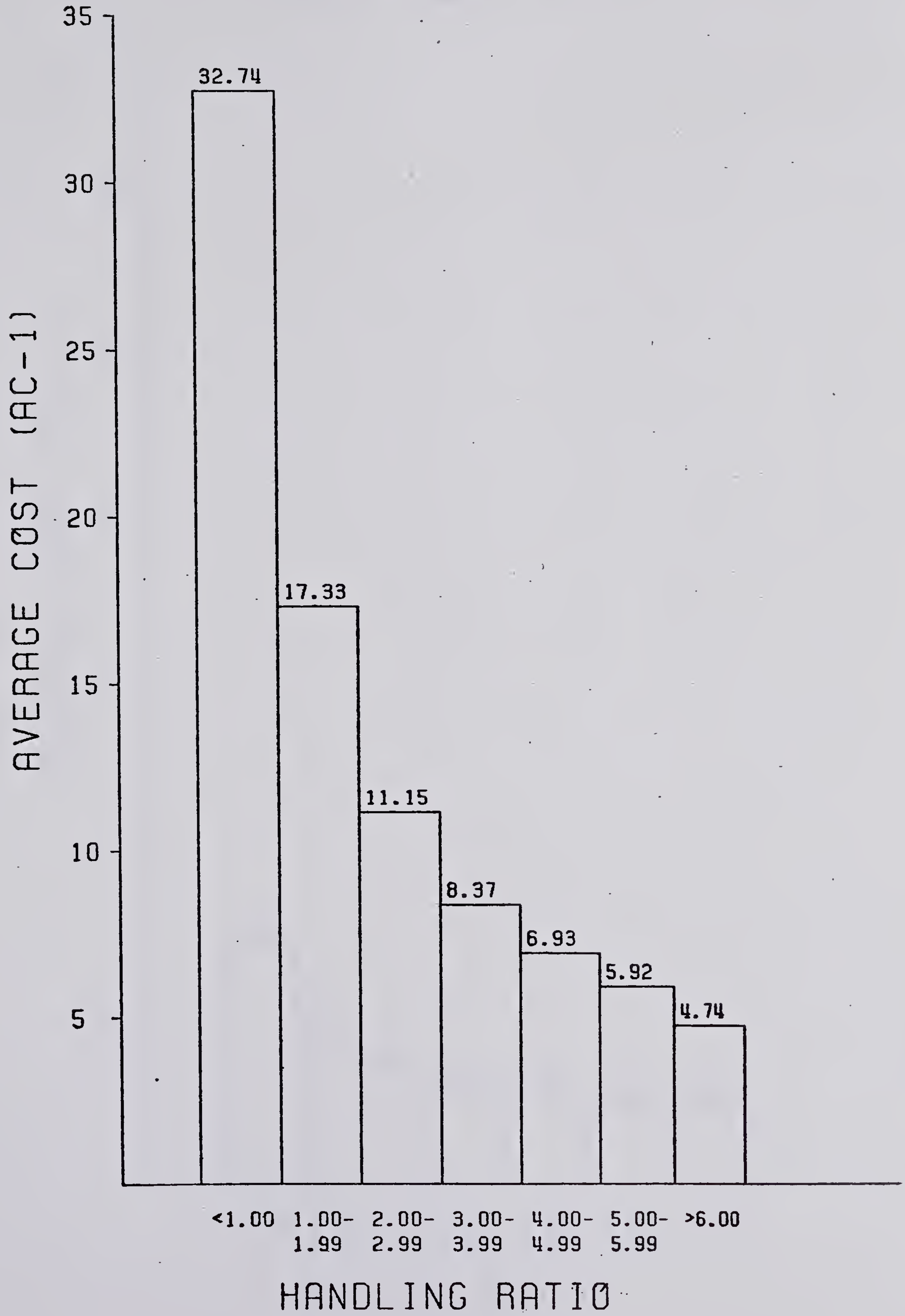


FIGURE V-8

AVERAGE COST PER TONNE
LESS DEPRECIATION AND
INTEREST ON INVESTMENT
BY ELEVATOR HANDLING RATIO
($ per tonne)

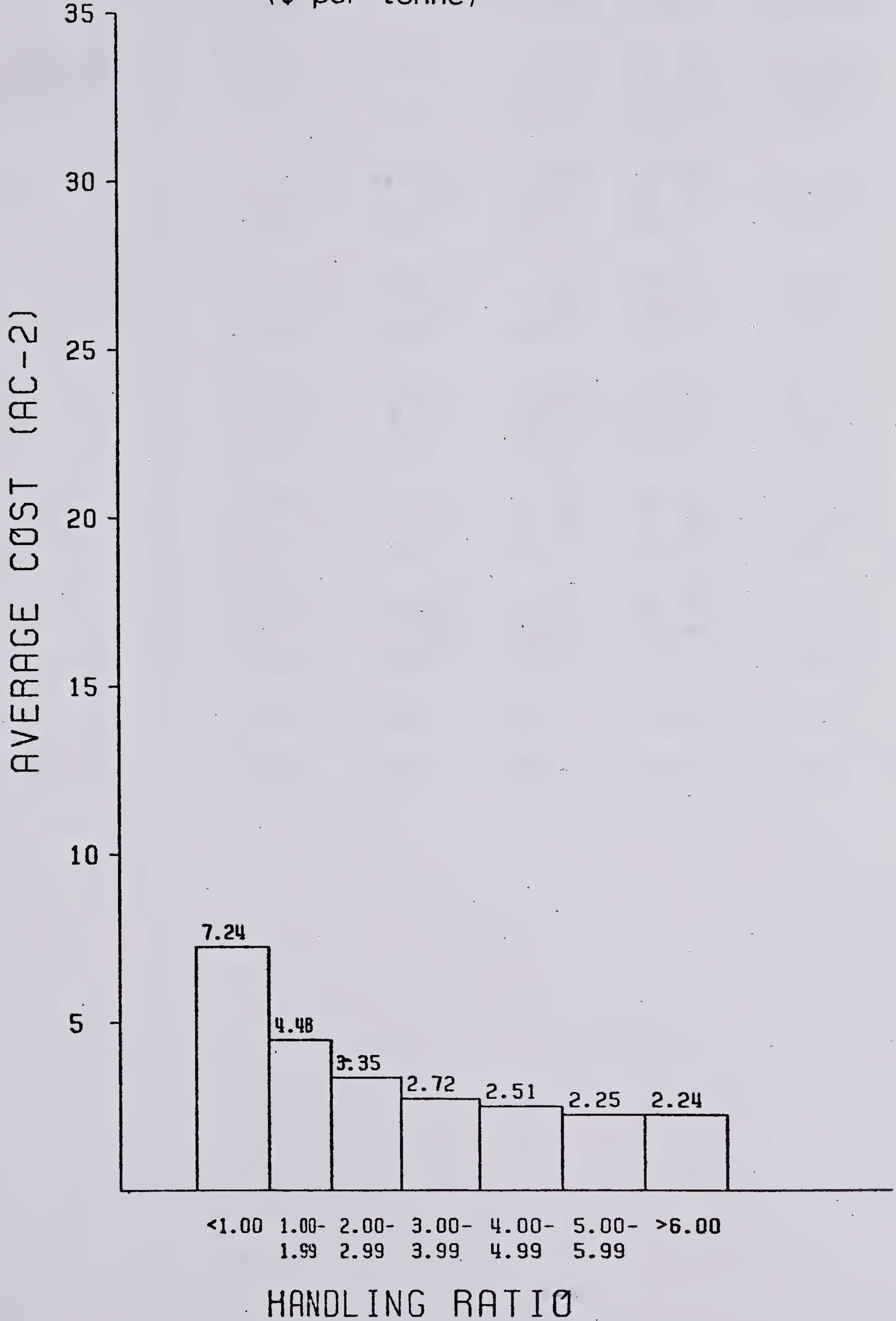


TABLE V-18

AVERAGE COST PER TONNE
BY ELEVATOR CAPACITY
($ per tonne)

		75/76	76/77	77/78	78/79	Period
Lowest through	x	9.93	9.33	11.22	12.79	10.81
2000 tonnes	s	(4.10)	(3.13)	(5.58)	(6.54)	(5.12)
capacity	N	(31)	(32)	(31)	(31)	(125)
	x	11.14	10.66	11.28	13.96	11.77
2001-3000	s	(4.28)	(3.83)	(4.77)	(5.75)	(4.85)
	N	(37)	(40)	(40)	(40)	(157)
	x	10.20	9.90	11.12	12.14	10.83
3001-4000	s	(4.46)	(4.28)	(4.03)	(4.65)	(4.71)
	N	(46)	(49)	(49)	(47)	(191)
	x	9.94	9.95	12.15	11.33	10.86
4001-5000	s	(3.78)	(4.33)	(10.66)	(5.55)	(6.71)
	N	(31)	(34)	(34)	(33)	(132)
Over	x	8.56	11.04	11.70	10.21	10.48
5000 tonnes	s	(1.57)	(4.18)	(6.76)	(2.60)	(4.33)
capacity	N	(8)	(10)	(10)	(10)	(38)
	x	10.23	10.06	11.42	12.43	11.04
Total	s	(4.11)	(3.98)	(6.52)	(5.44)	(5.19)
	N	(153)	(165)	(164)	(161)	(643)
F value		.87	.68	.15	1.62	1.07
Significant at		.49	.61	.96	.17	.37

average cost (cost per tonne) for elevators in Alberta was $11.04 between 1975/76 and 1978/79 (not deflated). It is possible that the assumption of $160 per tonne to construct an elevator is not valid for capacities under 3000 tonnes. Construction cost figures for smaller elevators were not available but one could argue that construction costs on a per tonne basis would be higher and therefore reveal a higher average cost than larger elevators. Note in Table V-18 the large standard deviation for elevators in the 4001-5000 tonne capacity range for 1977/78, although no explanation for this wide dispersion can be given.

Conversely, average costs (AC-2) with depreciation and interest on capital investment excluded, did yield significance at the .01 level when stratified by elevator capacity (Table V-19). This means there is more variation with this type of average cost between different capacity groups than within these capacity groups. This observation concurs with the regression results and the R^2 increase with the stepwise inclusion of capacity to the equations.

Receipts of grain delivered to primary elevators is an important variable in determining average costs. However, because this variable is a component (numerator) of handling ratio and handling ratio explained more variation in average cost than that of receipts by themselves the variable was dropped from the regression equation. Effect of receipts on average cost are reported in Tables V-20 and V-21 and are included in order to show the effect receipts of grain did

TABLE V-19

AVERAGE COST PER TONNE
LESS DEPRECIATION AND
INTEREST ON INVESTMENT
BY ELEVATOR CAPACITY
($ per tonne)

		75/76	76/77	77/78	78/79	Period
Lowest through 2000 tonnes capacity	x	3.03	3.28	4.00	4.79	3.77
	s	(1.32)	(1.01)	(1.74)	(2.06)	(1.71)
	N	(31)	(32)	(31)	(31)	(125)
2001-3000	x	2.69	3.14	3.46	4.34	3.42
	s	(.86)	(1.02)	(1.34)	(1.40)	(1.31)
	N	(37)	(40)	(40)	(40)	(157)
3001-4000	x	2.38	2.85	3.41	4.08	3.18
	s	(.83)	(.91)	(1.05)	(1.28)	(1.20)
	N	(46)	(49)	(49)	(47)	(191)
4001-5000	x	2.09	2.69	3.37	3.67	2.97
	s	(.57)	(.68)	(1.66)	(1.25)	(1.28)
	N	(31)	(34)	(34)	(33)	(132)
Over 5000 tonnes capacity	x	1.89	2.96	2.91	3.09	2.76
	s	(.31)	(.79)	(1.17)	(.41)	(.87)
	N	(8)	(10)	(10)	(10)	(38)
Total	x	2.50	2.98	3.50	4.14	3.29
	s	(.90)	(.91)	(1.41)	(1.46)	(1.34)
	N	(153)	(165)	(164)	(161)	(643)
F value		5.81	2.25	1.54	3.90	8.07
Significant at		.01	.07	.19	.01	.01

TABLE V-20

AVERAGE COST PER TONNE
BY ELEVATOR RECEIPTS
($ per tonne)

		75/76	76/77	77/78	78/79	Period
Lowest through 5000 tonnes in Receipts	x	14.23	14.99	18.88	18.76	16.75
	s	(4.75)	(5.33)	(11.29)	(6.85)	(7.61)
	N	(37)	(27)	(30)	(38)	(132)
5001-10000	x	10.43	10.58	11.18	12.31	11.13
	s	(3.18)	(2.77)	(2.71)	(2.72)	(2.92)
	N	(56)	(61)	(69)	(59)	(245)
10001-15000	x	8.07	8.52	8.61	9.38	8.63
	s	(1.76)	(2.12)	(2.23)	(1.98)	(2.07)
	N	(42)	(54)	(43)	(40)	(179)
15001-20000	x	6.69	6.97	7.85	8.24	7.50
	s	(1.20)	(1.49)	(1.40)	(1.80)	(1.60)
	N	(14)	(11)	(15)	(16)	(56)
20001-25000	x	5.34	6.02	7.03	7.87	6.34
	s	(.84)	(1.17)	(.57)	(.78)	(1.19)
	N	(3)	(11)	(5)	(2)	(21)
25001-30000	x	7.00	5.58	7.29	6.65	6.68
	s	(0)	(0)	(0)	(1.07)	(.90)
	N	(1)	(1)	(1)	(5)	(8)
Over 30000 tonnes in Receipts	x	0	0	5.15	5.94	5.54
	s	(0)	(0)	(0)	(0)	(.56)
	N	(0)	(0)	(1)	(1)	(2)
Total	x	10.23	10.06	11.42	12.43	11.04
	s	(3.21)	(3.04)	(5.31)	(3.93)	(4.08)
	N	(153)	(165)	(164)	(161)	(643)
F value		20.34	23.78	13.92	26.26	67.19
Significant at		.01	.01	.01	.01	.01

TABLE V-21

AVERAGE COST PER TONNE
LESS DEPRECIATION AND
INTEREST ON INVESTMENT
BY ELEVATOR RECEIPTS
($ per tonne)

		75/76	76/77	77/78	78/79	Period
Lowest through	x	3.60	4.23	5.21	5.61	4.67
5000 tonnes	s	(1.10)	(.85)	(2.04)	(1.78)	(1.73)
in Receipts	N	(37)	(27)	(30)	(38)	(132)
	x	2.46	3.07	3.45	4.04	3.27
5001-10000	s	(.53)	(.70)	(.82)	(1.19)	(1.01)
	N	(56)	(61)	(69)	(59)	(245)
	x	1.97	2.59	2.90	3.43	2.71
10001-15000	s	(.44)	(.61)	(.88)	(.79)	(.86)
	N	(42)	(54)	(43)	(40)	(179)
	x	1.64	2.31	2.52	3.36	2.50
15001-20000	s	(.32)	(.71)	(.50)	(1.00)	(.93)
	N	(14)	(11)	(15)	(16)	(56)
	x	1.39	2.00	2.42	2.87	2.09
20001-25000	s	(.09)	(.30)	(.64)	(.33)	(.55)
	N	(3)	(11)	(5)	(2)	(21)
	x	1.78	2.38	2.24	2.99	2.67
25001-30000	s	(0)	(0)	(0)	(.48)	(.59)
	N	(1)	(1)	(1)	(5)	(8)
Over	x	0	0	2.34	3.11	2.73
30000 tonnes	s	(0)	(0)	(0)	(0)	(.55)
in Receipts	N	(0)	(0)	(1)	(1)	(2)
	x	2.50	2.98	3.50	4.14	3.29
Total	s	(.68)	(.68)	(1.14)	(1.25)	(1.14)
	N	(153)	(165)	(164)	(161)	(643)
F value		30.68	20.60	16.21	13.22	49.00
Significant at		.01	.01	.01	.01	.01

have on average costs.

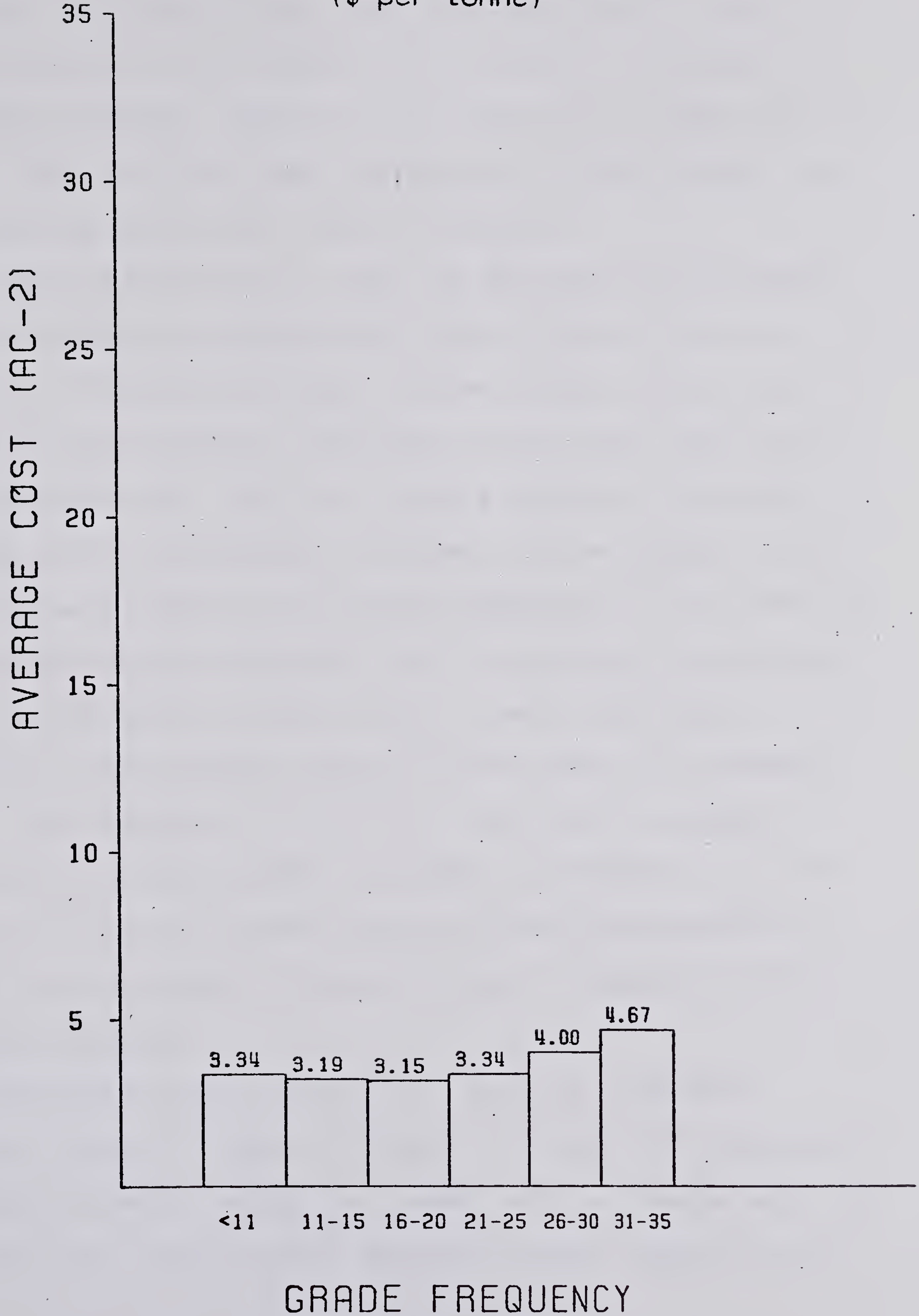
Average cost per tonne (AC-1) stratified by receipts in 5,000 tonne increments is shown in Table V-20. Elevators which received less than 5,000 tonnes per year had an average cost per tonne of $16.75 based on the four year average. At the other end of the scale, elevators which received more than 30,000 tonnes per year had an average cost per tonne of $5.54 based on the four year average. On a wheat equivalent basis, approximately 28,000 tonnes of grain are equivalent to 1 million bushels. Elevator managers obtaining a volume over 1 million bushels in a crop year are usually given an award for this achievement.

Table V-21 shows the relationship between elevator receipts and average cost per tonne; however, this average cost per tonne figure is less depreciation and interest on capital investment (AC-2).

Figure V-9 shows the average cost of primary elevators (AC-2 or cash operating costs) with receipts between 5001-10000 tonnes, grouped by grade frequency. Elevators in this stratum showed a decline in average cost with an increase in grades up to the 16-20 grouping. After that grouping, average cost increased as the grade frequency increased. Elevators in this stratum show an average cost of $3.34 per tonne if they received fewer than 11 grades while an average cost of $4.67 per tonne was incurred with elevators receiving grades in the 31-35 grouping. The lowest average cost per tonne ($3.15 per tonne) was realized in the

FIGURE V-9

AVERAGE COST (AC-2) OF ELEVATORS
WITH RECEIPTS BETWEEN 5001-10000 TONNES,
STRATIFIED BY GRADE FREQUENCY
($ per tonne)



16-20 grade frequency grouping. No elevators in this stratum of receipts received more than 35 grades in a year.

The elevators in Figure V-9, of which there were 245 over the four year period, were the only ones to show this upward sloping relationship at both ends of the grade frequency grouping. Other stratum below 5000 tonnes and above 10000, in 5000 tonne increments to 30000 tonnes, did not show any consistent trend or pattern.

Figure V-9 brings to light an important relationship between numbers of grades and volume of grain receipts. There is a trade-off between too few grades and too many grades in which primary elevators receive and store grain. Too few grades can restrict receipts and hence increase average cost. A few grades for which little demand exists can fill up a elevator and cause congestion in the elevator, thereby decreasing throughput and increasing average costs. On the other hand too many grades create operational problems at the primary elevator which can also increase costs. For elevators in the 5001-10000 tonne receipts stratum the optimum number of grades to receive is in the range of 16 to 20. Further analysis would be required in order for conclusions to be made about the entire primary elevator industry.

Average cost per tonne (AC-1 and AC-2) based on elevator region is shown in Tables V-22 and V-23. Region A (Southern Alberta) shows the lowest cost per tonne based on the four year average while Region B (South Central) and

TABLE V-22

AVERAGE COST PER TONNE
BY ELEVATOR REGION
($ per tonne)

		75/76	76/77	77/78	78/79	Period
Region A	x	8.98	9.39	11.53	11.05	10.26
	s	(4.42)	(3.59)	(6.06)	(4.69)	(4.84)
	N	(27)	(29)	(29)	(29)	(114)
Region B	x	9.71	11.45	12.46	13.12	11.70
	s	(3.04)	(4.22)	(5.58)	(5.52)	(4.82)
	N	(41)	(44)	(44)	(42)	(171)
Region C	x	12.26	10.76	10.88	12.97	11.70
	s	(4.82)	(3.55)	(3.14)	(5.65)	(4.45)
	N	(35)	(39)	(39)	(39)	(152)
Region D	x	10.86	9.61	9.22	11.84	10.36
	s	(3.59)	(2.68)	(2.62)	(5.23)	(3.75)
	N	(27)	(27)	(26)	(25)	(105)
Region E	x	8.84	7.83	12.57	12.62	10.52
	s	(3.73)	(4.60)	(12.17)	(6.24)	(7.74)
	N	(23)	(26)	(26)	(26)	(101)
Total	x	10.23	10.06	11.42	12.43	11.04
	s	(3.95)	(3.81)	(6.43)	(5.59)	(5.17)
	N	(153)	(165)	(164)	(161)	(643)
F value		4.04	4.35	1.33	.80	2.69
Significant at		.01	.01	.26	.53	.03

TABLE V-23

AVERAGE COST PER TONNE
LESS DEPRECIATION AND
INTEREST ON INVESTMENT
BY ELEVATOR REGION
($ per tonne)

		75/76	76/77	77/78	78/79	Period
	x	2.04	2.73	3.31	3.54	2.92
Region A	s	(.96)	(.96)	(1.65)	(1.29)	(1.37)
	N	(27)	(29)	(29)	(29)	(114)
	x	2.39	3.23	3.67	4.08	3.35
Region B	s	(.70)	(.96)	(1.51)	(1.67)	(1.41)
	N	(41)	(44)	(44)	(42)	(171)
	x	3.02	3.22	3.53	4.33	3.54
Region C	s	(1.06)	(.84)	(1.00)	(1.47)	(1.21)
	N	(35)	(39)	(39)	(39)	(152)
	x	2.81	3.12	3.06	4.24	3.29
Region D	s	(.98)	(.79)	(.87)	(1.20)	(1.10)
	N	(27)	(27)	(26)	(25)	(105)
	x	2.09	2.32	3.79	4.50	3.21
Region E	s	(.68)	(.69)	(1.88)	(1.68)	(1.68)
	N	(23)	(26)	(26)	(26)	(101)
	x	2.50	2.98	3.50	4.14	3.29
Total	s	(.89)	(.87)	(1.42)	(1.49)	(1.36)
	N	(153)	(165)	(164)	(161)	(643)
F value		7.07	6.14	1.18	1.76	3.60
Significant at		.01	.01	.32	.14	.01

Region C (Central) have the highest cost per tonne average. However, no strong statisitical significance between average cost and region of elevator location was found to exist.

C. Summary

This chapter described the source, collection and analysis of the data surrounding this elevator study. Regression techniques and analysis of variance were used to determine the factors which were hypothesized to be of influence to primary elevator operations. In particular, the regression analysis considered handling ratio, capacity, age, grain frequency, grade frequency and grain receipts, and the influence they had on primary elevator average costs. In addition various regional differences were studied in conjunction with the factors mentioned.

The numbers of grades handled by primary elevators was found to have a positive effect upon primary elevator average costs. As numbers of grades received by primary elevators increased then average costs increased. This relationship was significant at the .05 level.

For elevators receiving between 5001 and 10000 tonnes per year it was found that as grade frequency increased, average cost decreased until the 16-20 grade frequency grouping. After that point average cost began to rise as the number of grades received increased (Figure V-9). An upward shaped curve depicts this relationship with the point of lowest average cost being in the 16-20 grade frequency

grouping. This relationship was not found to exist for the primary elevator industry as a whole. The number of grains was not analyzed is this manner, only the number of grades.

Receipts of grain to elevator capacity expressed as a ratio was found to be the single most dominant factor in estimating and explaining the variation in primary elevator average costs. Receipts of grain as a component by itself was not found to be good (in terms of R^2) in explaining variation in primary elevator average costs but instead it was best represented as a component in conjunction with elevator capacity, in the form of a ratio.

Taken from the tables, AC-1 over the four crop year period was $11.04, AC-1 for 1978/79 only was 12.43. Also taken from the tables, AC-2 over the four crop year period was $3.29 and for the 1978/79 average was $4.14.

In order that these costs figures stated are not taken out of context, an explanation of what these two costs represent is needed. AC-1 includes all cash expenses directly incurred at the primary elevator plus a calculated cost by the author for depreciation and interest on captial. Administration costs from area departments or head offices were not allocated. Therefore, if allocation of these costs were made, as done by the budget departments of the companies in order to distribute costs back onto revenue centers, this average cost figure would be higher. On the other hand if only book depreciation was used instead then the average cost figure calculated would be lower than the

stated figure. In addition, all costs are current year dollar figures except construction costs, which are constant dollar figures ($160 per tonne). Further, this $160 figure was used for all elevator capacities but it may be argued that smaller elevators could have a higher figure, on a per tonne basis, than larger elevators. Figures wre not obtainable which could clarify this point.

AC-2 is essentially the cash operating expenses directly incurred by the primary elevators. As it can be argued that certain fixed costs bear no direct relationship to grade frequency at a primary elevator this cost (AC-2) may be viewed as the more important estimate of the effect grade frequencies have on elevator operations.

A total number of ten different grains were handled by primary elevators over the period between 1975/76 and 1978/79. In order of highest receipts in tonnes, wheat, barley, oats and rapeseed were the most prominant. The average number of grains received per year at a primary elevator over the four year time period was 4.85. Large elevators (over 5,000 tonnes) had a higher grain frequency average than smaller elevators (under 2,000 tonnes). No strong regional variation in grain frequency was found to exist; however, the kind of grain delivered showed variation.

The average number of grades received per year by primary elevators over the four year time period was 17.50, with a standard deviation of 5.99. The 1977/78 crop year

showed the highest grade frequency average of 18.52 different kinds of grades. Larger elevators received more different grades per year than smaller elevators and the Peace Region (Region E) received more grades than regions in the south, particularly Central Alberta (Regions B and C). The average grade frequency in the Peace Region was 23.79 over the four year period while Central Alberta had an average of 15.13 different kinds of grades delivered.

In terms of primary elevator receipts, a low of 9,152 tonnes were delivered per elevator in 1975/76 and a high of 10,207 tonnes per elevator were delivered in 1976/77. The average over the four year period was 9,602 tonnes. Elevators with a capacity of under 2,000 tonnes received 5,684 tonnes per crop year and primary elevators over 5,000 tonnes received 16,805 tonnes per crop year over the four year period.

In terms of regional differences between elevators with respect to grain receipts the Peace Region showed the highest four year annual average of 12,467 tonnes. Region C (Central Alberta) showed the lowest four year annual average at 8,399 tonnes. Region C also has more elevators competing for receipts over a given production area than other regions.

Other regional differences included age and capacity. The Peace Region has newer, larger elevators than the four other Alberta regions. Region E (Peace Region) had an average construction date of 1960 and an average elevator

capacity of 3,658 tonnes. The oldest elevators were found to exist in Region B (South Central) and the smallest elevators in Region D (North East). The average age was 34 years old (basis 1979) giving an average construction date of 1945. The average elevator capacity was found to be 3,197 tonnes.

Handling ratio varied with respect to elevator capacity and elevator region. The variation was significant at the .01 level when the four crop year averages were considered. Elevators with less than 2,000 tonnes capacity had an average handling ratio of 3.67 while elevators over 5,000 tonnes in capacity had an average of 2.85. Comparing handling ratio by region revealed that Region E (Peace Region) had the highest average handling ratio of 3.45 over the four year period and Region C (Central) had the lowest average at 2.75. These regional highs and lows also correspond to grain receipts and in turn affect average cost. Region B (South Central) and Region C (Central) were found to have lower handling ratios, lower grain receipts and higher average costs (AC-1 or AC-2).

Analyzing cash operating costs (AC-2) and handling ratios on a regional basis appears to show elevators in Region A (South) are more operationally efficient. Region A had a period average cost of $2.92 per tonne and Region E (Peace Region) had a period average cost of $3.21 per tonne. However, Region E attained a higher four year average

handling to capacity ratio of 3.45 versus Region A's 3.27.[1]

In terms of economies to scale in the primary elevator system cash operating expenses (AC-2), shown as average cost per tonne, declined with elevator capacity increases (Table V-19). Average cost declined from $3.77 per tonne with elevators less than 2,000 tonnes capacity to $2.76 per tonne with elevators 5,000 tonnes and greater in capacity.

Chapter six summarizes and makes conclusions and recommendations based on the results of the findings presented in this chapter. A potential study of a similar nature on the port terminal elevators in Vancouver will also be introduced.

----

[1]Refer to Table V-15 and Table V-23.

VI. SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

A. Summary

This report examined several factors, one of which is the number of domestic grain grades primary elevators in Alberta are required to handle. The main objective of this report was to evaluate the effect of domestic grain grades on the operational efficiency of primary elevators. Chapter I was used to introduce the objectives, central problem and the various hypotheses that would be tested in this research project. Various grain handling and transportation studies in connection with primary elevator operations in general and the impact of the number of grain grades on primary elevator operations and costs in particular were reviewed in Chapter II. The function of a grading system and an overview of the Canadian grain grading system, with certain parallels drawn with other countries' systems, are detailed in Chapter III.

Chapter IV was used to introduce the operations of handling grain grades at the primary elevator level. An understanding of how a manager receives, bins and ships particular grades of grain is useful in ascertaining what probable cost impacts the numbers of grades may have. Also included in this chapter is an account of the formation of grain co-operatives, and the development and the trends that have occurred in the past and that are occurring presently.

The peak number of primary elevators occurred in the mid-1930s. During the next two decades elevator numbers remained fairly stable before starting to decline. In the early 1970s system capacity started to decline, despite the trend toward larger, more operationally efficient facilities. The main reason behind the decline in primary elevator numbers and increased joint management of primary elevators was and still is, rising costs. However, by reviewing primary elevator companies' annual reports one is able to see the financial magnitude of the capital investment in new facilities. These new facilities are costly to build and can exert unfavorable cash flow balances on elevator companies. Elevator companies, and the industry in general, are constantly looking for possible ways of reducing or offsetting such costs. The problem of elevator companies in formulating reliable and accurate planning and investment strategies to handle or offset increases is the uncertainty surrounding the branch line network and the source of funds.

B. Hypothesis Test Results

The hypotheses tested were either accepted or rejected at the .01 level of significance.

Hypothesis 1 - Accept H_1. There is a significant relationship between the number of grades of grain received by a primary elevator and average cost. The number of grades received by primary elevators was not found to be as

important in reducing average costs as first hypothesized. Even though the number of grades are imposing a cost on primary elevators, at the present time the primary elevator system is capable of handling the current number of grades as defined the Canada Grain Act. This position does not take into account the impact the number of grades may have on other components of the system such as the port terminals and the scheduling of rail cars.

However, this brings to light one important variable or quality which was not accounted for at individual primary elevators; namely management. Good managers are proficient in blending and mixing different grades of grain and are thus able to reduce the number of grades which can tie up storage and working space. The more effectively managers can perform this function the less partially filled bins of uncommon grades he will have to handle and schedule rail cars for.

In addition, the larger primary elevators were found to handle more grades than smaller elevators. Yet, larger modernized facilities seemed to be able to cope adequately with the number of grades that are at present delivered to primary elevators. If one assumed that better management is placed into the larger elevators rather than the smaller facilities then this further complicates the measurement of any cost impact of handling varying numbers of grades.

Calculations with the double log equation (using AC-1) show that increasing the number of grades handled by five

from a number of 16 grades per elevator increases the average cost per tonne by seven cents. Reducing the number of grades received from the average by five decreases the average cost per tonne by eleven cents. In other words, reducing the number of grades received from the average by five decreases the average cost per tonne by approximately 1% of total elevator costs.

Hypothesis 2 - Accept H_1. There is a significant relationship between the number of grains received by a primary elevator and average cost. The results show that as the number of grains increased, average cost decreased. The direction of this relationship was somewhat different than that anticipated because it was felt that as the number of grains increased it would reduce the ability to blend grades and thus increase average cost.

Hypothesis 3 - Cannot reject H_0. There is no significant relationship between the volume of grain received by a primary elevator and average cost. While the volume of grain received will affect average cost it was not found to be significant in explaining variation in average costs because the volume of receipts to capacity ratio (Hypothesis 4) picked up and explained the variation in average cost better than volume of receipts by itself. The correlation coefficient between volume of receipts and handling to capacity ratio was .71.

Hypothesis 4 - Accept H_1. There is a significant relationship between the receiving to capacity ratio of a

[illegible]

primary elevator and average cost. This variable was found to be the single most important factor in explaining the variation in average costs at primary elevators. As the handling to capacity ratio increased, average cost per tonne decreased. This type of relationship serves as an incentive to primary elevators to become more throughput oriented in order to cope with increasing costs. The primary elevator system does not appear to be a bottleneck in the overall grain handling and transportation system; there is potential for increased handling to capacity ratios. What must be noted is the level of receipts to primary elevators is in many ways determined outside of the primary elevator system. Efficiently run primary elevators could increase their handling ratios if such factors as weather conditions, rail car allocations and other transportation circumstances do not inhibit this improvement. Not discovered was at what point the average cost curve of primary elevators would begin to turn up, if at all. The sample data did not include sufficient numbers of elevators with high handling ratios to be able to show this relationship.

Hypothesis 5 - Accept H_1. There is a significant relationship between the capacity of a primary elevator and average cost. As elevator capacity increased so did total costs, but because larger elevators could offset this increasing total cost with larger volumes of grain, average cost per tonne declined. Therefore as primary elevator capacity increases average cost per tonne decreases. Small

elevators that can maintain the receival of large volumes of grain can be as cost efficient as large elevators; however, this omits any increased maintenance and repairs that may be encountered in the long run if the smaller elevators were utilized to that extent.

Hypothesis 6 - Accept H_1. There is a significant relationship between the age of a primary elevator and average cost. Primary elevators 25 years and older (basis 1979) were found to have higher average costs per tonne than newer primary elevators. This factor is based solely on the date the facility was built as it was not feasible to detail any equipment and machinery improvements that may have taken place since the date of construction.

C. Recommendations on the Canadian Domestic Grain Grading System

As mentioned previously, the Inspection Division of the Canadian Grain Commission has issued as many as 800 grade certificates identifying different grades which have been delivered to primary elevators in the Western Division. From the sample data used for the purposes of this research 141 different grades were received in 1975/76, 123 in 1976/77, 127 in 1977/78 and 136 in 178/79.

The average number of different grades received by each primary elevator was 19.46 in 1975/76, 14.76 in 1976/77, 18.52 in 1977/78 and 17.41 in 1978/79. The average number of different grades received by each primary elevator was 17.50

over the four year period.

Results from this research appear to indicate that average costs tend to increase at primary elevators when the number of different grades received increases beyond the 16-20 grouping. A histogram depicting this relationship between average cost (AC-2) and grade frequency stratified by receipts is shown in Figure V-9.

The data (regression results and Figure V-9) appear to show that since most elevators receiving more than 30 grades per year are isolated cases, the overall primary elevator system is able to handle adequately the number of grades stipulated under the Canada Grain Act. The grade effect on average cost appears to be minimal when comparing the impact to the variable, handling to capacity ratio. However, it is recommended that the number of different grades present in the Canadian domestic grain grading system not increase unless there is strong market pressure to expand the present domestic grade designations.

Seasonal variation may also be an important issue with respect to the impact of grading on elevator throughput. This research used twelve month period averages and therefore did not measure the effect of heavy handling periods of for example June and July. The number of grades may be more critical at these peak periods.

The difference in the manner in which elevators developed in Canada relative to the United States should also be noted. Canada may have additional elevator

construction costs because of the need to build more bins of smaller capacity to handle the present grading system in operation. The American operation utilizes fewer bins of larger capacities, as this structure is best suited to their grading system.

The trend toward computerized account facilities and protein testers for grain in primary elevators will probably accelerate in the 1980s. The success of this modernization will depend on current technology and the ability of managers to utilize the new equipment. It appears as though this change will improve the coordinating function of spotting rail cars with the required grades needed for the various grain sales commitments. Inventory control will be improved and by adding protein content as one of the grade factors will enable grain producers to be paid for the quality of product they produce.

While such a step can be seen as a positive move, the present 800 different kinds of grades received on the prairies could increase above this figure. This increase in the number of grades has been shown to increase the average cost at primary elevators. Establishing protein levels in other grades, similar to 1 and 2 C.W.R.S. wheat at 13.5% protein content, should be justified first in order to insure advantages in pricing efficiency offset disadvantages in operational efficiency.

D. Recommendations for Future Research

Alternative operating methods of increasing throughput at port terminal elevators have included pooling grains, switching between elevators, interchanging cars between railroads and specialization of certain grains in certain elevators. "Unfortunately, nearly all of these kinds of changes increase the capacity of one part of the system at the expense of a loss of capacity in another."[1] For example port elevators which specialize in a few grades may better utilize elevator and storage capacity but that improvement may come at the expense of increased car movements and lengthened car cycles. "The decision to accumulate durum at the Saskatchewan Wheat Pool terminal, for example, requires C.P. cars carrying durum to be transferred to C.N."[2]

Apparently some specialization at the port terminals at Vancouver does occur. Durum is only handled in the Saskatchewan Wheat Pool and winter wheat only in the Alberta Wheat Pool. Saskatchewan Wheat Pool and Pacific Elevators usually handle rye, while Alberta Wheat Pool and United Grain Growers usually handle flax.[3] Again the main operational problem of specialization is in the handling and sorting of rail cars. Cars not going to the same elevator as other cars within the same train require splitting out and

----

[1]Booz-Allen and Hamilton Inc. Grain Transportation and Handling in Western Canadda: Technical Report. Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.) Chapter VII, p. 17.
[2]Ibid., Chapter VII, p. 17.
[3]Ibid., Chapter VII, p. 17.

this is creating problems at the main yards of the two major railways in Vancouver. Of note is the point that while specialization of the current number of grades may not lead to increased efficiency, decreased numbers of grades over the entire system which then reduces the number of grades received by terminals may lead to increased operational efficiency. In addition, one must realize why we have a grain transportation problem in the first place. Reducing the number of grades may increase operational efficiency but this change may also reduce the demand for grain which precipitated the transportation problems initially.

One must be careful in reducing total costs in the overall grain handling and transportation system because lowering costs on one sector may also shift costs to another sector. An overall planning approach to the system's problems is what is required for the grain industry.

This approach also applies to any change that may be proposed and attempted with respect to reducing the number of grades in Canada's grain grading system. Altering the present domestic grading system should be adequately researched at the port terminal level (the export standard level) in order to fully understand the market implications and procedural problems from such a change.

References

AGRICULTURE CANADA. Canadian Red Spring Wheat, 1978 Crop. Winnipeg: Canadian Grain Commission, Grain Research Laboratory, 1978.

ALBERTA WHEAT POOL. Alberta Wheat Pool, 1979 Annual Report. Calgary: Alberta Wheat Pool, 1979.

AUSTRALIAN WHEAT BOARD. Australian Wheat Board Annual Report, 1976-77. Melbourne: Australian Wheat Board, 1978.

AUSTRALIAN WHEAT BOARD. The Australian Wheat Industry. Melbourne: Australian Wheat Board, 1978.

BECKMAN, THEODORE, N., DAVIDSON, WILLIAM R. and TALARZYK, W. WAYNE. Marketing. 9th ed. New York: Ronald Press, 1973.

BOES, ALLAN. (Supervisor, Cut-off & Shipments, United Grain Growers.) Personal Communication, 1979.

BOOZ-ALLEN & HAMILTON INC. Grain Transportation and Handling in Western Canada: Technical Report. Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.)

BREIMYER, HAROLD F. Economics of the Product Markets of Agriculture. Ames: Iowa State University Press, 1976.

BROOK, R.C., BAKKER-ARKEMA. F.W. and HILL, L.D. Grain Shipments to World Markets. St. Joseph, Michigan: American Society of Agricultural Engineers, 1976.

CANADA DEPARTMENT OF AGRICULTURE. What You Should Know About Wheat. Publication 1286. Ottawa: Supply and Services, 1977.

CANADA GAZETTE. Part II, Vol. 105, No. 6.

CANADA GRAIN ACT, Statutes of Canada 1970, c. 7.

CANADA GRAINS COUNCIL. Canadian Grains Industry: Statistical Handbook '79. Winnipeg: C.G.C., 1979.

CANADA GRAINS COUNCIL. Domestic Feed Grain Policy: A Report of the Advisory Committee. Winnipeg: C.G.C., 1979.

CANADA GRAINS COUNCIL. Grain Handling and Transportation: Definition of the Problem. Winnipeg: C.G.C., 1975.

CANADA GRAINS COUNCIL. Grain Handling and Transportation: State of the Industry. Winnipeg: C.G.C., 1973.

CANADA GRAINS COUNCIL. Key Issues In Canadian Grain Transportation: A Background Paper. Winnipeg: C.G.C., 1979.

CANADA GRAINS COUNCIL. Metric Measurement Standards Practice Guide for the Canadian Bulk Grain Handling Industry. Winnipeg: C.G.C., 1976.

CANADIAN GRAIN COMMISSION. Grain Elevators in Canada. Winnipeg: C.G.C. Various Issues.

CANADIAN GRAIN COMMISSION. Maximum Tariffs of Elevator Charges. Winnipeg: C.G.C., 1979.

CANADIAN GRAIN COMMISSION. Notice of Intent to Amend Certain Grade Definitions in Schedule I of the Canada Grain Act Effective August 1, 1973. Circular No. 72-2. Winnipeg: C.G.C., 1972.

CANADIAN GRAIN COMMISSION. Official Grain Grading Guide, 1979 Edition. Ottawa: Supply and Services, 1979.

CANADIAN GRAIN COMMISSION. Specifications for Official Grades of Canadian Grain. Schedule One of the Canada Grain Act. Winnipeg: C.G.C., 1978.

CANADIAN INTERNATIONAL GRAINS INSTITUTE. Grains and Oilseeds: Handling, Marketing, Processing. 2nd ed. Winnipeg: Canadian International Grains Institute, 1975.

CANADIAN WHEAT BOARD. Annual Report, 1977/78. Winnipeg: C.W.B., 1979.

CANADIAN WHEAT BOARD. Quota Update. Winnipeg: C.W.B., (October 1979).

CANADIAN WHEAT BOARD ACT. Statutes of Canada 1970, c. 16.

CANDLISH, J. Primary Elevator Operations in Canada. Winnipeg: United Grain Growers, Date Uncited.

CAVES, RICHARD. American Industry: Structure, Conduct, Performance. 4th ed., Englewood Cliffs: Prentice-Hall, Inc., 1977.

COPELAND, MICHAEL D. and CRAMER, GAIL L. An Efficient Organization of the Montana Wheat Marketing System. Bulletin 667. Bozeman: Montana Agricultural Experiment Station, Montana State University, 1973.

CORN QUALITY CONFERENCE 1977. Proceedings, 1977 Corn Quality Conference. Urbana-Champaign: Department of Agricultural Economics, University of Illinois, 1978.

DEYONG, E.R., and KULSHRESHTHA, S.N. A Computer Program for Determining an Optimum Number and Location of Grain Assembly Points (Version II). Saskatoon: Department of Agricultural Economics, University of Saskatoon, 1978.

DOLL, JOHN, P., RHODES, JAMES and WEST, JERRY G. Economics of Agricultural Production, Markets and Policy. Illinois: Richard D. Irwin, Inc., 1968.

DUKE, V. Grain Quality-Control Within the Canadian Grain Handling System: The Operations of the Inspection Division of the Canadian Grain Commission. Winnipeg: C.G.C., 1975.

EVANS, GORD. (Supervisor, Cut-offs & Shipments, Alberta Wheat Pool.) Personal Communication, 1979/80.

FEDERAL GRAIN INSPECTION SERVICE. Report on the Adequacy of Existing Official U.S. Standards for Grain. Washington: U.S.D.A., 1979.

FLEMING, M.S. and YANSAINI, P.A. Prairie Grain Handling and Transportation System Efficiency. No. 10-78-18. Ottawa/Hull: Canadian Transport Commission Research Branch, 1978.

FOODWEST RESOURCE CONSULTANTS. U.S. Grain Handling and Transportation With Selected Comparisons to the Canadian System. Edmonton, 1979. (Prepared for Alberta Transportation.)

FREEBAIRN, J.W. Segregation of New South Wales Wheat: An Economic Investigation. Misc. Bulletin No. 4. Sydney: New South Wales, Department of Agriculture, 1968.

FULLER, STEPHEN W. and MANUEL, MILTON L. Factors That Affect Country Grain Elevator Operation. Bulletin 550. Manhattan, Kansas: Agricultural Experiment Station, 1972.

HALL COMMISSION. Grain and Rail in Western Canada. Vol. I. Ottawa: Supply and Services, 1977.

HILL, LOWELL D. Improving Grades and Standards for Soybeans. Urbana-Champaign: Department of Agricultural Economics, University of Illinois, Date Uncited.

HILL, LOWELL D., PAULSEN, MARVIN R. and BROOKS, BRUCE L. Grain Quality Losses Between Origin and Destination of Export Grain: A Case Study. AE-4399. Urbana-Champaign: Department of Agricultural Economics, Agricultural Experiment Station, University of Illinois, 1976.

HILL, LOWELL D., PAULSEN, MARVIN R. and HILLER, DANIEL. Corn Breakage as Affected by Handling During Shipment. AE-4403. Urbana-Champaign: Department of Agricultural Economics, Agricultural Experiment Station, University of Illinois, 1976.

HOFFMAN, KATHEYN J. and HILL, LOWELL D. "Historical Review of the U.S. Grades and Standards for Grain." Illinois Agricultural Economics, Vol. 16, No. 1 (January 1976), pp. 1-9.

HORNGREN, C.T. Cost Accounting: A Managerial Emphasis. 4th ed. Englewood Cliffs: Prentice-Hall, 1977.

IBI GROUP. Impact on Transportation Users of Changing Statutory Grain Rates. Vancouver, 1979. (Prepared for Alberta Economic Development.)

IOWA DEVELOPMENT COMMISSION. Corn Grading Standards: A Study of Present Corn QUality Levels and the Economic Effect of Proposed Changes in U.S.D.A. Grades. Project P-94. Des Moines: Iowa Development Commision, 1977.

JOHNSTON, J.H. (Economist, Department of Agriculture, Sydney, Australia.) Personal Communication, 1979.

JOHNSON, P.R. "Some Aspects of Estimating Statistical Cost Functions." Journal of Farm Economics, Vol. 46, Part I (1964), pp. 179-187.

KAUFMANN, H.H. "Changes in Grain Inspection and Standards." Cereal Foods World, Vol. 22, No. 5 (May 1977), pp. 198-200.

KETILSON, N.D. Improving the Exporting Capability of Grain Co-operatives. Regina: Saskatchewan Wheat Pool, 1977.

KMENTA, JAN. Elements of Econometrics. New York: Macmillan, 1971.

KOCH, JAMES, V. Industrial Organization and Prices. Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1974.

KOHLS, L.R. "Towards a More Meaningful Concept of Marketing Efficiency." Journal of Farm Economics, Vol. 38, No. 1 (February 1956), pp. 68-73.

KOHLS, L.R. and DOWNEY, W.D. Marketing of Agricultural Products. 4th ed. New York: Macmillan, 1972.

KULSHRESHTHA, S.N. and DEVINE, D.G. "Historical Perspective and Propositions on the Crowsnest Pass Freight Rate Agreement." Canadian Journal of Agricultural Economics, Vol. 26, No. 2 (1978), pp. 72-83.

LYSTER, LES M. "The Impact of the Canadian Wheat Board on the Western Canadian Feed Grains Market." Unpublished Master of Agricultural paper, Dept. of Rural Economy, University of Alberta, 1978.

MACGIBBON, D.A. The Canadian Grain Trade. Toronto: Macmillan, 1932.

MADDALA, G.S. Econometrics. New York: McGraw-Hill, 1977.

MADILL, J.W. A Review of Canadian Grain Marketing. Calgary: Alberta Wheat Pool, 1970.

MARTIN, F.L., DEVINE, D.G. and KULSHRESHTHA, S.N. "Centralized Prairie Grain Collection: Savings Related to Market Efficiency." Canadian Journal of Agricultural Economics, Vol. 26, No. 2 (1978), pp. 18-34.

MECHREN, G.L. "The Function of Grades in an Affluent, Standardized-Quality Economy." Journal of Farm Economics, Vol. 43, Part I (1961), pp. 1377-1383.

MENZIES, M.W. "Grain Marketing Methods in Canada: The Theory, Assumptions, and Approach." American Journal of Agricultural Economics, Vol. 55, No. 5 (December 1973), pp. 791-799.

MINER, W.M. International Agreements Affecting Grain Trading. Ottawa: Dept. of Industry, Trade and Commerce, Date Uncited.

MUNDLAK, YAIR. "On the Pooling of Time Series and Cross Section Data." Econometrics, Vol. 46, No. 1 (January 1978), pp. 69-85.

PACIFIC NORTHWEST GRAIN STANDARDS & QUALITY COMMITTEE. Quality Wheat. Pendleton, Oregon: Pacific Northwest Grain Standards & Quality Committee, 1978.

PATTON, H.S. Grain Grower's Cooperation in Western Canada. Cambridge: Harvard University Press, 1928.

PAULSEN, MARVIN R. and HILL, LOWELL D. Corn Breakage in Overseas Shipments: Two Case Studies. St. Joseph, Michigan: American Society of Agricultural Engineers, 1977.

PEPPER, PHILLIP and HILL, LOWELL D. The Attitudes of Farmers and County Elevator Managers Toward Present and Proposed Grain Standards. AERR 151. Urbana-Champaign: Dept. of Agricultural Economics, Agricultural Experiment Station, University of Illinois, 1977.

RUNCIMAN, A.M. (President, United Grain Growers Limited.) Personal Communication, 1979.

SARGENT, G.R. Agri-Insight. Calgary: Alberta Wheat Pool, Vol. 6, No. 6, 1976.

SCHRADER, LEE F. and LANG, MAHLON G. Impact of Commodity Grade Specification Changes: The Case of BCFM and FM in Corn and Soybeans. West Lafayette, Indiana: Dept. of Agricultural Economics, Purdue University, 1979.

SHARP, J.W. Cost of Storing, Handling, Merchandising Grain at Ohio Country Elevators. No. 124. Wooster: Ohio Agricultural Experiment Station, 1963.

SHELLENBERGER, J.A. "International Standards for Grain." Cereal Foods World, Vol. 22, No. 2 (February 1977), pp. 73-74.

SNAVELY, KING and ASSOC. 1977 Costs and Revenues Incurred by the Railways in the Transportation of Grain Under the Statutory Rates. Ottawa: Grain Transportation Branch, Transport Canada, 1978.

SOGN, A.B. Grain Merchandising at the Country Elevator. No. 102. Brookings: Agricultural Experiment Station, South Dakota State College, 1959.

SORFLATEN, ALLAN G. Peformance of the Country Grain Elevator Industry in Southwestern Ontario. Toronto: Farm Economics, Co-operatives and Statistics Branch, Ontario Department of Agriculture and Food, 1967.

STICKLAND, KEN W. "A Grain Handling and Transportation Policy System." Unpublished Master of Science thesis, Dept. of Rural Economy, University of Alberta, 1976.

STOREY, D.A. Organization and Operation of Illinois Grain Processors, Terminal Elevators and Sub-Terminal Elevators. Bulletin No. 692. Urbana-Champaign: Agricultural Experiment Station, University of Illinois, 1963.

STOREY, D.A. and GILLFILLAN, R.A. Illinois Country Grain Elevator Financial Organization and Operation. Bulletin No. 702. Urban-Champaign: Agricultural Experiment Station, University of Illinois, 1964.

TEBBUTT, H.R. and COOKSLEY, K.J. The Crow's Nest Agreement: How It All Began. Calgary: Alberta Wheat Pool, 1978.

THE TRANSPORTATION AGENCY OF SASKATCHEWAN. The Crow Rate and National Transportation Policy. Regina: Queen's Printer, 1977.

THE CANADIAN GRAIN MARKETING REVIEW COMMITTEE. (M.W. Menzies, Chairman.). The Report of the Canadian Grain Marketing Review Committee. Winnipeg, 1971. (Submitted to the Canadian Wheat Board.)

TIPPLES, K.H. "Canadian Wheat Quality in a Changing World Market." Cereal Foods World, Vol. 21, No. 9 (September 1976), pp. 485-487.

TROCK, W.L. Costs of Grain Elevator Operation in the Spring Wheat Area. Bulletin No. 593. Bozeman: Montana Agricultural Experiment Station, 1965.

TROCK, W.L. Trends and Prospective Developments in Grain Elevator Operations. Bulletin No. 596. Bozeman: Agricultural Experiment Station, Montana State College, 1965.

UNITED GRAIN GROWERS. 72nd Annual Report to the Shareholders of United Grain Growers for the Year Ended July 31, 1978. Winnipeg: U.G.G. 1978.

U.S.D.A. Cost of Storing and Handling Grain and Controlling Dust in Commercial Elevators, 1971-72... Projections for 1973-74. Washington: U.S.D.A., Economic Research Service, 1973.

U.S.D.A. Receiving Grain at Country Elevators: Hard Winter Wheat Area. Research Report 638. Washington: U.S.D.A., 1964.

U.S.D.A. The Official United States Standards for Grain. Washington: U.S.D.A., Federal Grain Inspection Service, 1978.

WALTERS, A.A. "Production and Cost Functions: An Econometric Survey." Econometrics, (January-April 1963), pp. 1-53.

WARRACK, A.A. "A Conceptual Framework for Analysis of Marketing Efficiency." Canadian Journal of Agricultural Economics, Vol. 20, No. 3 (1972), pp. 9-22.

WILLARD, S. Calculus for Business Economics. Edmonton: Dept. of Mathematics, University of Alberta, 1973.

WILLIAMS, WILLARD F. and STOUT, THOMAS T. Economics of the Livestock-Meat Industry. New York: Macmillan, 1964.

WILLS, WALTER J. An Introduction to Grain Marketing. Illinois: Interstate Printers and Publishers, Inc., 1972.

WILSON, CHARLES F. A Century of Canadian Grains. Saskatoon: Western Producers Prairie Books, 1978.

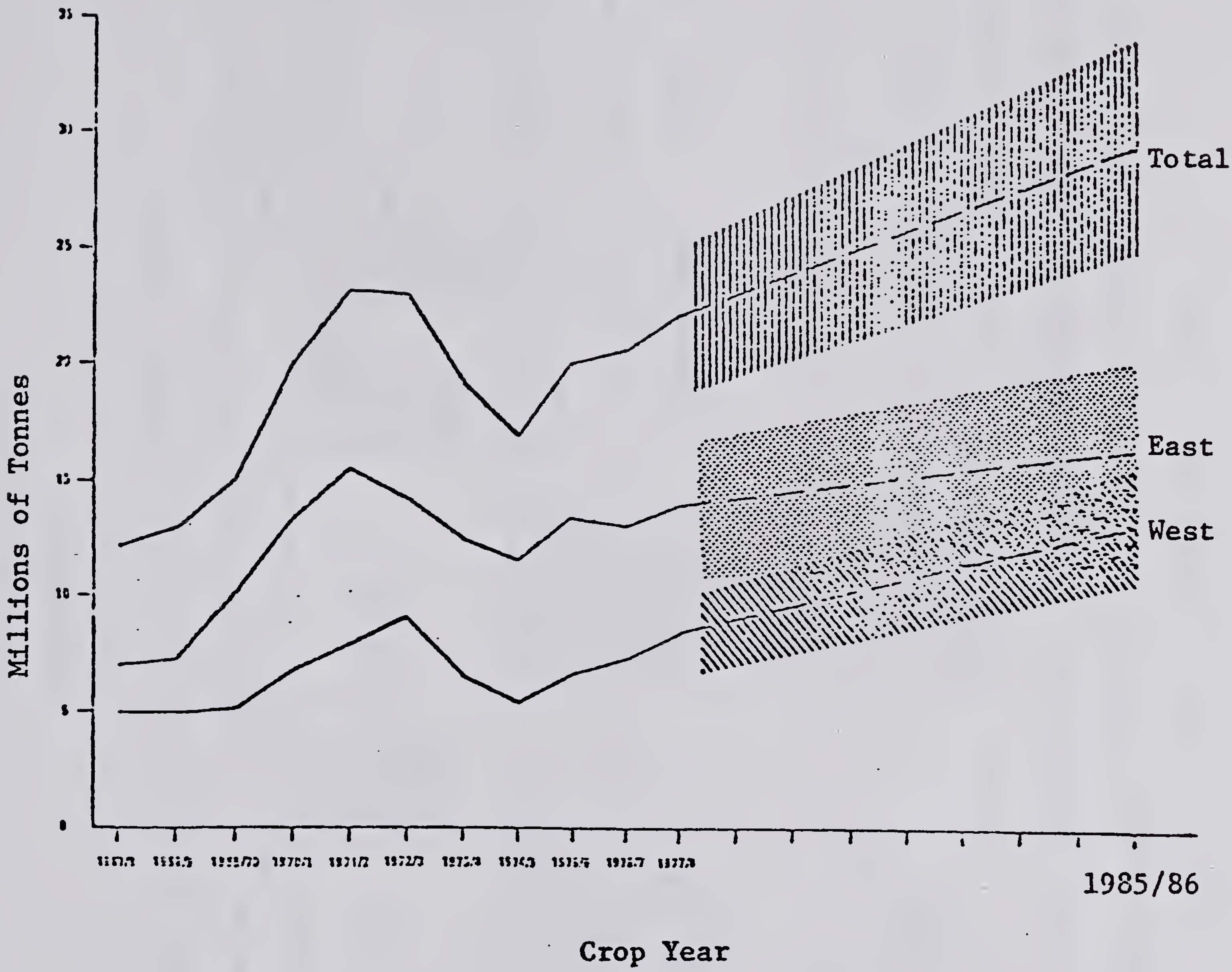
WILSON, CHARLES F. Grain Marketing in Canada. Winnipeg: Canadian International Grains Institute, 1979.

ZASADA, DON and TANGRI, OM P. An Analysis of Factors Affecting the Cost of Handling and Storing Grain in Manitoba Country Elevators. Research Report 13. Winnipeg: Faculty of Agriculture and Home Economics, University of Manitoba, 1967.

ZUSMAN, P. "A Theoretical Basis for Determining of Grading and Sorting Schemes." Journal of Farm Economics, Vol. 49, Part I, No. 1 (February 1967), pp. 89-106.

Appendix A

Expected Growth in Movement of Principal Western Canadian Grains.



Source: Booz-Allen and Hamilton Inc., Grain Transportation and Handling in Western Canada: Technical Report, Bethesda: Booz-Allen and Hamilton Inc., 1979. (Report for Department of Industry, Trade and Commerce, Grains Group, Ottawa.)

Appendix B

Grades of Red Spring Wheat (Canada Western)

Grade Name	Standard of Quality				Maximum Limits of			
					Foreign Material Other Than Wheat		Wheats of Other Classes or Varieties	
	Minimum Kilograms per Hectolitre	Variety	Minimum Percentage by Weight of Hard Vitreous Kernels	Degree of Soundness	Matter Other Than Cereal Grains	Total Including Cereal Grains Other Than Wheat	Durum	Total Including Durum
No. 1 Canada Western Red Spring	75	Marquis or any Variety equal to Marquis	65	Reasonably well matured, reasonably free from damaged kernels	Practically free	About 0.75%	About 1%	About 3%
No. 2 Canada Western Red Spring	72	Marquis or any variety equal to Marquis	35	Fairly well matured, may be moderately bleached, or frost damaged, but reasonably free from severely weather damaged kernels.	Reasonably free	About 1.5%	About 3%	About 6%
No. 3 Canada Western Red Spring	69	Any variety of fair milling quality	--	Excluded from higher grades on account of frosted, immature or otherwise damaged kernels.	Reasonably free	About 3.5%	About 5%	10%

Source: Canadian Grain Commission, Specifications for Official Grades of Canadian Grain, Schedule One of the Canada Grain Act, Winnipeg: Canadian Grain Commission, 1978, p. 1.

Appendix C

Official Grade Names of Grain, 1979/80

Class 1 Grades (Statutory) as Defined in
the Canada Grain Act and Regulations

Grain	Grade Names by Number C.W. - Canada Western; C.E. - Canada Eastern; C. - Canada
Red Spring Wheat	1,2,3 C.W.
Utility Wheat	1,2,3 C.
Soft White Spring Wheat	1,2,3,4 C.W.
Winter Wheat	1,2,3 C.W. Red Winter
Amber Durum Wheat	1,2,3,4,5 C.W.
Oats	1,2 C.W., Extra 1 Feed, 1,2,3 Feed
Barley	1,2 C.W. Six-Row, 1,2 C.W. Two-Row 1,2,3 Feed
Rye	1,2,3 C.W. Ergoty
Mixed Grain	1,2,3,4,5 C.W.
Flaxseed	1,2,3,4 C.W.
Rapeseed	1,2,3 C.
Corn	1,2,3,4 C.W. Yellow, 1,2,3,4 C.W. White, 1,2,3,4 C.W. Mixed
Buckwheat	1,2,3 C.
Sunflower	1,2,3 C.
Domestic Mustard Seed	1,2,3,4 C. Yellow, 1,2,3,4 C. Oriental 1,2,3,4 C. Brown, 1,2,3,4 C. Mixed
Peas(1)	1,2,3 C.W., Extra 4 C.W., 4 C.W.
Red Spring Wheat	1,2,3,4,5 C.E.
White Winter Wheat	1,2,3 Extra 4, 4, Extra 5,5 C.E.
Red Winter Wheat	1,2,3,4,5 C.E.
Mixed Winter Wheat	1,2,3,4,5 C.E.
Mixed Wheat	1,2 C.E.
Oats	1,2,3,4,5 C.E.
Barley	1,2 C.E. Six-Row, 1,2 C.E. Two-Row, 1,2,3 Feed
Rye	1,2,3 C.E. Ergoty, 1,2,3, C.E. Special
Mixed Grain	1,2,3,4 C.E.
Corn	1,2,3,4,5 C.E. Yellow, 1,2,3,4,5 C.E. White, 1,2,3,4,5 C.E. Mixed
Beans(2)	Extra 1 C.E., 1,2,3,4 C.E.
Peas	1,2,3,4 C.E. White, 1,2,3,4 C.E. Marrowfat, 1,2,3,4 C.E. Black Eye, 1,2,3,4 C.E. Mixed
Soybeans	1,2,3,4,5 C. Yellow, 1,2,3,4,5 C. Green, 1,2,3,4,5 C. Brown, 1,2,3,4,5 C. Black, 1,2.3,4.5 C. Mixed
Flaxseed	1,2,3,4 C.E.

---

(1) C.W. Peas are graded with type and colour forming part of the grade name, except that, upon request, the variety instead may be shown as part of the grade name. For example: No. 3 C.W. Small Yellow, or No. 3 C.W. Century Variety

Common Types	Examples of Elegible Varieties
Small Yellow	Arthur, Century, Chancellor
Large Yellow	
Small Green	

(2) The Class name, whether Pea Beans or other edible beans shall be added to and become part of the grade name. Examples of other class names: Yellow Eye, White Kidney, Light Red Kidney, Dark Red Kidney, Cranberry, Azuki.

Appendix C (cont'd)

Class II Grades (Special Grades) as Defined in the Canada Grain Regulations

Grain	Grade Names by Number
Beans(1)	Extra 1 C.W. Pea Beans, 1,2,3,4 C.W. Pea Beans, Sample C.W. Pea Beans
Safflower Seed	1,2,3 C.W.
Red Spring Wheat	Extra 1 C.W. Extra 2 C.W.

Class III Grades (Off Grades) as Defined in the Off Grades of Grain and Grades of Screenings Order

All Class I Grains plus Safflower Seed and C.W. Beans, except that Beans with excessive moisture are only graded as Damp	Tough Damp	(To be added to and made part of a grade name and number according to the extent by which the moisture content exceeds the percentage limits specified for each grain)
Corn, Soybeans, Sunflower Seed and Safflower Seed	Moist Wet	
All Class I Grains plus C.W. Beans and Safflower Seed	Rejected-Account Dried Rejected-Account Odour Rejected-Account Admisture Rejected-Account Heated Rejected-Account Stones Rejected-Account Fire-burnt Rejected-Account Ergot	(To be added to and made part of a grade name and number except that Red Spring and Utility grades of Wheat are not graded "Rejected" for any reasons other than Stones and Dried. Where quality is affected by the other factors, these grains are downgraded to a lower grade, or graded as"Sample".)
All Class I Grains plus C.W. Beans and Safflower Seed)	Sample Salvage Sample	(e.g. from wrecks in transit) (The residual grade for any grain which does not qualify for any higher grade)
Lentils	1,2,3 C	
Fababeans	1,2,3,4 C. Sample C	

---

(1) The Class name, whether Pea Beans or other edible beans shall be added to and become part of the grade name. Examples of other class names: Yellow Eye, White Kidney, Light Red Kidney, Dark Red Kidney, Cranberry, Azuki.

Appendix C (cont'd)

Class IV Grades (Screenings) as Defined in the Off Grades of Grain and Grades of Screenings Order

Screenings	1.2 Feed, Uncleaned, Refuse, 1 and 2 Mixed
Sample Feed Grain	Feed Oats Mixtures of whole and broken grain which does not qualify for any statutory or off grade becuase of being so mixed.

Source: Canadian Grain Commission, Specifications for Official Grades of Canadian Grain, Winnipeg: C.G.C., 1979., SOR/78-479 to SOR/79-543, Canada Gazette, Part II, various issues, 1978-79., Charles F. Wilson, Grain Marketing in Canada, Winnipeg: Canadian International Grains Institute, 1979, p. 15.

Appendix D

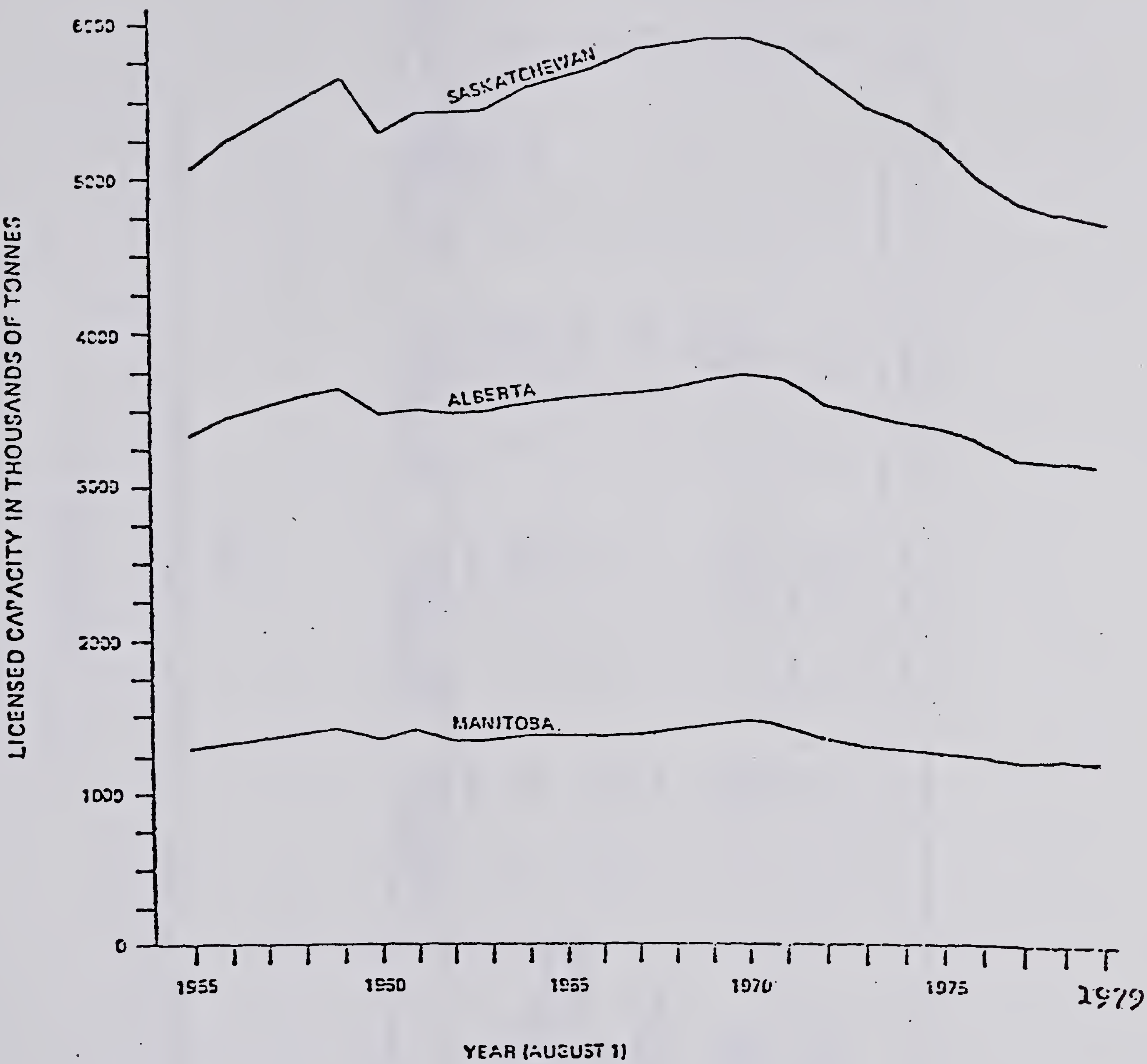
The Development of the Primary Elevation System (1900-1979)

Year	Licensed Elevators In Service	Increase	Decrease	Tot. Del. Pts.	No. of Companies (Primary)	No. of Operating Units	Lic. E. Capacity (tonnes)	Other Storage (tonnes)	Av. Cap'y Operating Unit (tonnes)	Av. Cap'y Delivery Point (tonnes)
1900	421						357,310			
1905	1,050	629					892,570			
1910	1,867	817					1,658,590			
1912	2,272	405					2,033,740			
1915	2,995	723			64		2,690,110			
1920	3,785	790			64		3,612,880			
1925	4,293	508			66		3,957,380			
1930	5,733	1,440			40		5,413,940			
1935	5,728		5		39		5,318,830			
1940	5,500 (52)		129		32		5,637,970	2,029,870		
1945	5,463 (170)		137	2,113	29		5,520,880	2,675,980		2,540
1950	5,309 (158)		154	2,139	23		7,926,910			2,710
1955	5,367 (36)	58		2,083	19		9,666,870	238,640		4,740
1960	5,299 (33)		71	2,068	17		10,130,670	200,800		4,890
1964	5,168		128	2,002	15	4,136	10,541,840		2,540	5,260
1965	5,139		29	1,983	15	4,062	10,674,020		2,620	5,380
1966	5,080		59	1,960	15	4,042	10,765,040		2,660	5,490
1967	5,032		48	1,941	13	3,980	10,910,200		2,740	5,620
1968	5,000		32	1,921	13	3,747	10,987,410		2,930	5,720
1969	4,983		17	1,915	13	3,652	11,097,560		3,030	5,790
1970	4,971		12	1,907	13	3,539	11,167,320		3,150	5,850
1971	4,849		122	1,835	12	3,477	11,031,680		3,170	6,010
1972	4,567		282	1,672	12	3,240	10,579,830		3,260	6,320
1973	4,383		184	1,617	10	3,073	10,306,190		3,350	6,370
1974	4,292		91	1,594	10	2,814	10,145,050		3,600	6,360
1975	4,165		127	1,556	9	2,623	9,954,180		3,790	6,390
1976	3,964		201	1,495	9	2,546	9,630,390		3,780	6,440
1977	3,739		255	1,417	9	2,467	9,317,170		3,770	6,570
1978	3,658		81	1,394		2,440	9,245,450		3,789	6,632
1979	3,528		130	1,351		2,376	9,052,740		3,810	6,700

Source: Charles F. Wilson, Grain Marketing in Canada, Winnipeg: Canadian International Grains Institute, 1979., and Canadian Grain Commission, Grain Elevators in Canada, Winnipeg: C.G.C., Various Issues.

Appendix E

Total Primary Elevator Capacity by Province



Source: Canadian Grain Commission, <u>Grain Elevators in Canada</u>, Winnipeg: C.G.C., Various Issues.

Appendix F

Licensed Primary Elevator Storage Capacity As at August 1, 1979

Licensee/Titulaire	MANITOBA Elevs./Silos	MANITOBA Storage/Entreposage	SASKATCHEWAN Elevs./Silos	SASKATCHEWAN Storage/Entreposage	ALBERTA Elevs./Silos	ALBERTA Storage/Entreposage	B.C./C.-B. Elevs./Silos	B.C./C.-B. Storage/Entreposage	TOTAL Elevs./Silos	TOTAL Storage/Entreposage
		tonnes		tonnes		tonnes		tonnes		tonnes
Alberta Wheat Pool	-	-	-	-	701	1,882,760	11	47,140	712	1,929,900
Canbra Foods Ltd.	-	-	1	1,530	1	840	-	-	2	2.370
Cargill Grain Company, Limited	27	75,580	129	305,490	66	152,560	2	8,280	224	541.910
Continental Grain Company (Canada) Limited	-	-	2	2,910	3	11,870	-	-	5	14.780
Ellison Milling Company A Division of Parrish & Heimbecker	-	-	-	-	1	11,030	-	-	1	11,030
Humboldt Flour Mills Co. Ltd.	-	-	1	5,320	-	-	-	-	1	5,320
Manitoba Pool Elevators	234	652,390	-	-	-	-	-	-	234	652.390
Maple Leaf Mills Limited	-	-	-	-	1	2,020	-	-	1	2.020
Maywest Grain Company Limited	-	-	-	-	2	1,150	-	-	2	1,150
McCallister Pea & Seed Cleaners Ltd.	1	3,080	-	-	-	-	-	-	1	3,080
Mighty Peace Grain Limited	-	-	-	-	-	-	1	7,080	1	7,080
NARP Processors Ltd.	-	-	-	-	1	4,200	-	-	1	4,200
Ogilvie Mills Ltd.	-	-	-	-	1	5.710	-	-	1	5,710
Parrish & Helmbecker, Limited	3	27,080	25	133,900	31	79,120	-	-	59	240.100
Paterson & Sons Limited, N.M.	36	104,900	47	127,480	2	5.730	-	-	85	238,110
Pioneer Grain Company, Limited	9	24,590	332	889,570	98	264,020	-	-	439	1.178,180
Ritz & Co., Henry	2	1,820	-	-	-	-	-	-	2	1,820
Saskatchewan Wheat Pool	-	-	1,126	2,546,990	-	-	-	-	1,126	2,546.990
Seedex Canada Limited	1	1,680	-	-	-	-	-	-	1	1,580
United Grain Growers Limited	104	286,030	251	635,530	266	684,720	8	33.660	629	1.639.940
Weyburn Inland Terminal Ltd.	-	-	1	24,980	-	-	-	-	1	24.980
TOTAL	417	1,177,150	1,915	4,673.700	1,174	3.105.730	22	96,160	3.528	9,052,740

Appendix F (cont'd)

Summary by Province & Company of Primary Elevator "Operating Units"

	MANITOBA		SASKATCHEWAN		ALBERTA		B.C./C.-B.		TOTAL	
Alberta Wheat Pool	-	-	-	-	406	(701)	7	(11)	413	(712)
Cargill Grain Company, Limited	23	(27)	98	(129)	49	(66)	2	(2)	172	(224)
Manitoba Pool Elevators	201	(234)	-	-	-	-	-	-	201	(234)
Parrish & Heimbecker, Limited	3	(3)	23	(25)	29	(31)	-	-	55	(59)
Paterson & Sons Limited, N.M.	33	(36)	36	(47)	1	(2)	-	-	70	(85)
Pioneer Grain Company, Limited	8	(9)	213	(332)	71	(98)	-	-	292	(439)
Saskatchewan Wheat Pool	-	-	728	(1,126)	-	-	-	-	728	(1,126)
United Grain Growers Limited	83	(104)	170	(251)	173	(266)	4	(8)	430	(629)
Other Licensed Companies/ Autres compagnies agréées	3	(4)	4	(5)	7	(10)	1	(1)	15	(20)
TOTAL	354	(417)	1,272	(1,915)	736	(1,174)	14	(22)	2,376	(3,528)

NOTE: In most instances where a grain company operates two or more primary elevators at one location, the operations have been combined under a single manager. This has been aided by the trading of elevators between companies. As a result of a move towards greater economy and efficiency, the 3,528 elevators individually licensed as at August 1, 1979 reflect only 2,376 'operating units'. The above table indicates this pattern, according to the major companies. The bracketed figures indicate the licensed separate units. It should be recognized that this statement reflects a constantly changing situation and is based upon the latest available data.

Appendix F (cont'd)

Country Shipping Points and Licensed Primary Elevators

By Province and Railway as at August 1, 1979

	MANITOBA			SASKATCHEWAN			ALBERTA			B.C./C.-B.			TOTAL		
	Stations/ Gares	Elevs./ Silos	Cap. (Tonnes)	Stations/ Gares	Elevs./ Silos	Cap. (Tonnes)	Stations/ Gares	Elevs./ Silos	Cap. (Tonnes)	Stations/ Gares	Elevs./ Silos	Cap. (Tonnes)	Stations/ Gares	Elevs./ Silos	Cap. (Tonnes)
C.P.	124	225	651,070	371	1,000	2,459,570	212	645	1,750,670	1	1	2,500	708	1,871	4,863,810
C.N.	115 (6)	192	526,080	360 (14)	915	2,214,130	139 (6)	376	886,470	-	-	-	614 (26)	1,483	3,626,680
N.A.R.	-	-	-	-	-	-	45 (1)	142	429,680	2	10	50,640	47 (1)	152	480,320
G.S.L.	-	-	-	-	-	-	4	10	34,710	-	-	-	4	10	34,710
B.C.R.	-	-	-	-	-	-	-	-	-	5 (1)	11	43,020	5 (1)	11	43,020
Not on Track	-	-	-	-	-	-	1	1	4,200	-	-	-	1	1	4,200
TOTAL	233	417	1,177,150	717	1,915	4,673,700	394	1,174	3,105,730	7	22	96,160	1,351	3,528	9,052,740
Single Company Points/Points d'une seuls compagnie 1/	159			357			194			5			715		

1/ Included in Railway Totals

Note: Bracketed items indicate stations served by more than one railway, included in individual railway totals but excluded from grand totals.

Source: Canadian Grain Commission, Grain Elevators in Canada, Crop Year 1979/80, Winnipeg: C.G.C., 1979.

Appendix G

Summary by Company, of Primary Elevator Operating Units in Alberta

(August 1)

Company	1973	1974	1975	1976	1977	1978	1979
Alberta Wheat Pool	549(845)	511(823)	463(806)	456(777)	429(734)	423(725)	406(701)
Cargill	-	-	53(78)	50(72)	49(71)	51(70)	49(66)
Ellison Milling & Elevator Co.	16(18)	15(18)	-	-	-	-	-
National Grain Ltd.	60(82)	59(81)	-	-	-	-	-
Parrish & Heimbecker Ltd.	21(21)	21(21)	37(37)	33(34)	32(34)	29(31)	29(31)
N.M. Paterson & Sons Ltd.	1(2)	1(2)	1(2)	1(2)	1(2)	1(2)	1(2)
Pioneer Grain Co. Ltd.	77(99)	78(98)	79(98)	75(98)	74(99)	72(99)	71(98)
United Grain Growers Ltd.	214(319)	193(310)	190(302)	183(299)	185(282)	180(273)	173(266)
Other Licensed Company	3(4)	4(4)	5(7)	5(8)	6(10)	9(10)	7(10)
TOTAL	941(1390)	882(1357)	828(1330)	803(1290)	766(1232)	765(1210)	736(1174)

Note: In most instances where a grain company operates two or more primary elevators at one location, the operations have been combined under a single manager. Unbracketed figures refer to operating units, bracketed figures refer to licensed separate units.

Source: Canadian Grain Commission, <u>Grain Elevators in Canada</u>, Winnipeg: C.G.C., Various Issues.

Appendix H

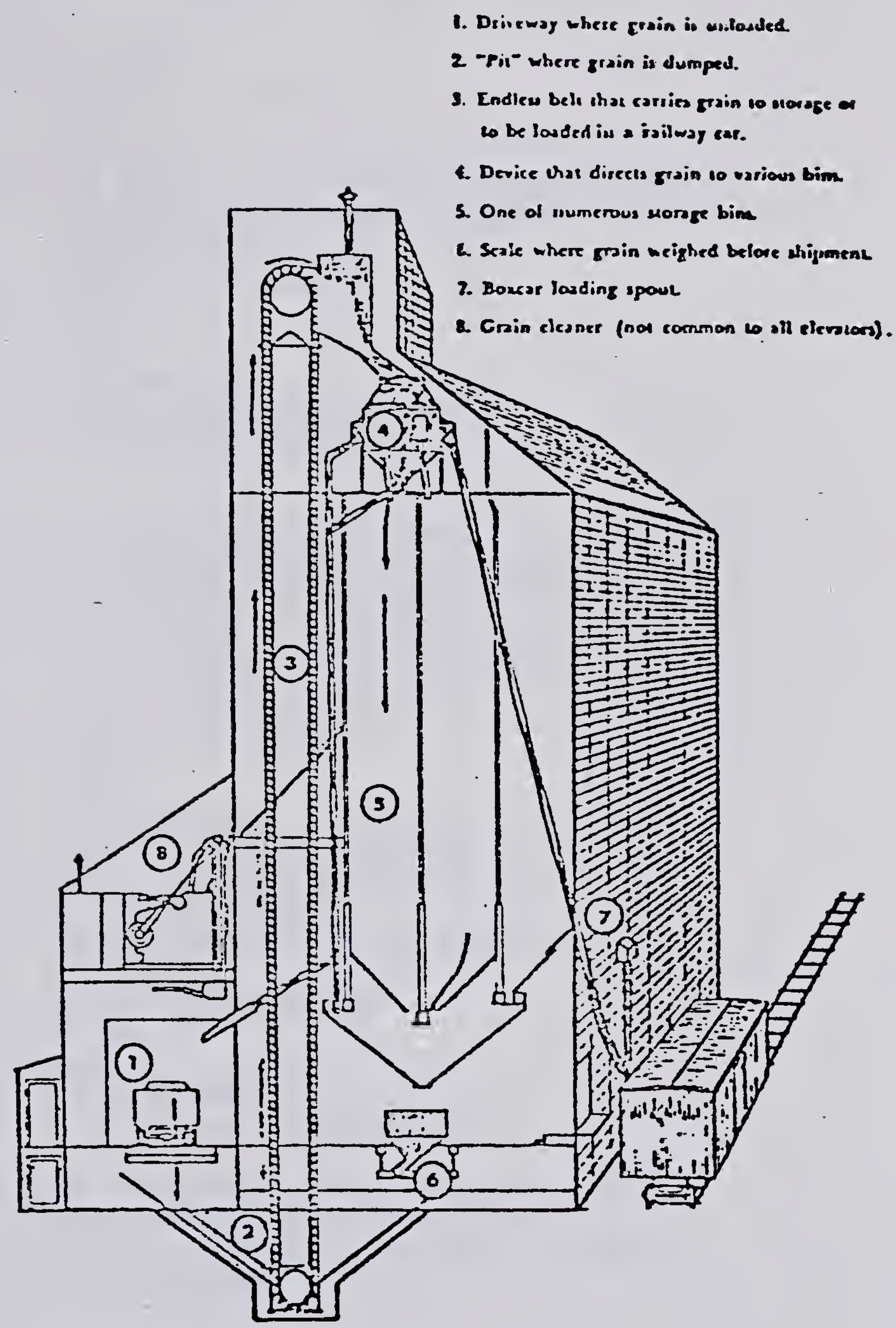
Licensed Primary Elevator Capacity (Tonnes) in Alberta (August 1)

Company	1973	1974	1975	1976	1977	1978	1979
Alberta Wheat Pool	2,121,104	2,081,264	2,063,407	2,009,130	1,926,740	1,922,300	1,882,760
Cangra Foods Ltd.	-	-	-	340	840	840	840
Cargill	-	-	173,804	161,120	156,410	156,640	152,560
Continental	-	-	10,220	10,220	10,750	10,750	11,870
Ellison Milling & Elevator Co. Ltd.	47,410	47,410	2,560	2,560	2,560	2,560	11,030
Hanna Seeds Ltd.	-	-	1,400	1,400	1,400	-	-
Lake of the Woods Milling Co. Ltd.	5,712	5,712	-	-	-	-	-
Maple Leaf Mills Ltd.	5,992	5,992	6,130	6,130	5,990	5,990	2,020
Maywest Grain Co. Ltd.	-	-	-	-	-	1,740	1,150
MEMCO	-	-	-	-	16,000	16,000	-
Milk River Grain Co. Ltd.	10,220	10,220	-	-	-	-	-
NARP Processors Ltd.	-	-	-	-	-	4,200	4,200
National Grain Ltd.	188,924	183,322	-	-	-	-	-
N.M. Paterson & Sons Ltd.	5,730	5,730	5,730	5,730	5,730	5,730	5,730
Ogilvie Mills Ltd.	-	-	5,710	5,710	5,710	5,710	5,710
Panish & Heimbecker Ltd.	44,464	44,464	88,528	84,500	83,910	79,120	79,120
Pioneer Grain Ltd.	268,280	267,380	267,380	267,440	266,020	263,610	264,020
United Grain Growers	766,164	757,455	745,923	739,550	702,790	697,970	684,720
TOTAL	3,464,000	3,409,000	3,370,800	3,293,830	3,184,850	3,167,270	3,105,730

Source: Canadian Grain Commission, Grain Elevators in Canada, Winnipeg: C.G.C., Various Issues.

Appendix 1

Section Through A Country Elevator



Appendix J

Maximum Tariffs of Elevator Charges Effective Sept. 1979

	Fee
1. Elevation	
(1) Receiving, elevating and loading out	
(a) wheat (including durum), soybeans, corn and rye	$ 6.50/t
(b) flaxseed and rapeseed	7.65/t
(c) barley	8.05/t
(d) oats	10.65/t
(e) sunflower seed	13.00/t
(f) other grains and screenings	8.95/t
(2) Additional Charges	
(a) Removal of dockage - terminal or primary cleaning.	
(i) wheat (including durum), soybeans, corn and rye	2.00/t
(ii) flaxseed and rapeseed	2.70/t
(iii) barley	2.50/t
(iv) oats	3.30/t
(v) sunflower seed	6.10/t
(vi) other grains and screenings	2.75/t
(b) Administration Consigned cars	45.00/car
2. Storage (including insurance against fire)	
(a) With respect to graded storage receipts and interim elevator receipts, for each succeeding day or part thereof after the first ten days.	
(i) wheat (including durum), soybeans, corn and rye	.020/t
(ii) flaxseed and rapeseed	.024/t
(iii) barley	.025/t
(iv) oats	.033/t
(v) sunflower seed	.040/t
(vi) other grains and screenings	.028/t
(b) With respect to all other storage, for each day or parth thereof	
(i) wheat (including durum), soybeans, corn and rye	.020/t
(ii) flaxseed and rapeseed	.024/t
(iii) barley	.025/t
(iv) oats	.033/t
(v) sunflower seed	.040/t
(vi) other grains and screenings	.028/t
3. Custom cleaning as requested by the owner of the grain (including receiving, elevating and loading out)	
(a) wheat (including durum), soybeans, corn and rye	8.50/t
(b) flaxseed and rapeseed	10.35/t
(c) barley	10.55/t
(d) oats	13.95/t
(e) sunflower seed	19.10/t
(f) other grains and screenings	11.70/t

Appendix J (cont'd)

4. Custom drying as requested by the owner of the grain (including receiving, elevating and loading out)

(a) wheat (including durum), soybeans and rye	$ 11.85/t
(b) flaxseed and rapeseed	13.95/t
(c) barley	14.70/t
(d) oats	19.40/t
(e) corn	15.55/t
(f) sunflower seed	23.70/t
(g) other grains and screenings	16.35/t

5. Administration for producer railway cars 115.00/car

NOTES: 1. The charges for elevation and storage of grain set out in this schedule shall be computed on the net weight of the grain delivered as shown on the cash purchase ticket or graded storage receipt issued in respect of the grain. Charges for elevation and storage for which interim or special bin receipts are issued with respect to the grain shall be computed on the accountable gross weight of the grain delivered.

2. The charges for custom cleaning and drying of grain set out in this schedule shall be computed on the weight of the grain unloaded as shown on the receipt or ticket issued in respect of the grain.

Source: Canadian Grain Commission, Maximum Tariffs of Elevator Charges, Winnipeg: C.G.C., 1979.

Appendix K

Quota Schedule

Grain	Per Acre Kg	Per Acre Bus.	Grades	Blocks	Termination Date
Board Grains					
Hard Red Spring Wht.	A - 140	5.1	All	All	
Canada Western Red Winter Wheat	A - 136	5.0	All	All	
Durum	A - 80	2.9	All	All	
Barley	A - 110	5.0	All	37-49,81-87, 90,95,98,B.C.	Nov. 9/79
	B - 110	5.0	All	37-49,81-87, 90,95,98,B.C.	
	C - 110	5.0	All	All	
	D - 220	10.1	All	1-35,61-79	Oct. 26/79
	E - 220	10.1	All	1-35,61-79	
Oats (Supplementary)	A -1160	75.2	Ex.1 Fd. & higher	All	

NOTE: All quotas listed above are general quotas unless otherwise stated. A general quota is one that will eventually be extended to all grades in all shipping blocks.

Grain	Kg	Bus.	Grades	Blocks
Off-Board Feed Grains				
Wheat	400	14.7	3 CW & lower	All
Oats	335	21.7	1 Fd. & lower	All
Barley	1 090	50.0	1 Fd. & lower	All
Non-Board Grains				
Rye	150	5.9	All	All
Rye to Distillers	400	15.7	All	All
Flaxseed	80	3.1	All	All
Flax to Crushers	400	15.7	All	All
Rapeseed	70	3.1	All	All
Rape to Crushers	400.	17.6	All	All

Source: Canadian Wheat Board, <u>Quota Update</u>, Winnipeg: C.W.B., Oct. 1979.

Appendix L

Regional Breakdown of Elevator Sample